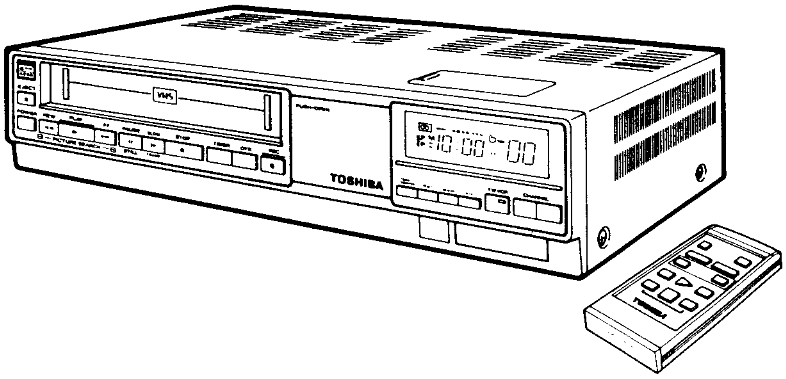
SERVICE DATA
FILE NO. 030-145-1

TOSHIBA
COLOR VIDEO CASSETTE RECORDER
M-5530TL THEORY OF OPERATION



SPECIFICATIONS

GENERAL

Video recording system:	Rotary 2-head helical scanning
Head configuration:	4-head rotary (Dedicated heads for SP & EP)
Video signal:	EIA standard NTSC color
Storage temperature:	–20°C to +60°C (–4°F to +140°F)
Operating temperature:	5°C to 40°C (41°F to 104°F)
Antenna:	75 ohms external antenna terminal for VHF 300 ohms external antenna terminal for UHF
Channel coverage:	VHF channels 2 – 13 UHF channels 14 – 83 CATV channels A_2, A_1, A – I, J – W, AA – JJ
VHF output signal:	Channel 3 or 4 (selectable) 73 dBμ, 75 ohms unbalanced

SETTING POSITION	CHANNEL
VL ch	2 – 6
VH ch	A_2, A_1, A – I, 7 – 13
U ch	14 – 83
CATV ch	J – W, AA – JJ

Power consumption:	34W (8W with power off)
Weight:	17.2 lb.
Dimensions:	16-15/16 x 3-3/4 x 14-3/4 inches (W.H.D)

VIDEO

Input:	VIDEO LINE IN: Phono jack 1.0V(p-p) 75 ohms unbalanced, sync. negative

VIDEO

Output:	VIDEO LINE OUT: Phono jack 1.0V(p-p) 75 ohms unbalanced, sync. negative
Signal to noise ratio:	[SP] : 45 dB

AUDIO

Input:	AUDIO LINE IN: Phono jack, 47k ohms, –10 dBs, unbalanced
Output:	AUDIO LINE OUT: Phono jack, less than 10k ohms, –7 dBs, unbalanced (load: more than 47k ohms)
Frequency response:	[SP] : 80 Hz to 12 kHz
Signal to noise ratio:	[SP] : Better than 40 dB

TAPE TRANSPORT

Tape speed:	SP 33.35 mm/sec., LP16.67 mm/sec., EP 11.12 mm/sec.
Maximum recording time:	480 min. with T-160 tape (EP mode)
Fast forward time:	Within 5.0 min. (T-120)
Rewind time:	Within 5.0 min. (T-120)

TIMER

Fluorescent digital display
Count down from AC line frequency.

Remote Control Unit

12 key: 17 modes. Infared Remote Control Operation

Design and specifications are subject to change without notice.

Caution: The unauthorized recording of television programmes and other materials may infringe on the rights of others.

SAFETY NOTICE

SAFETY PRECAUTIONS

LEAKAGE CURRENT CHECK

Plug the AC line cord directly into a 120V AC outlet (do not use an isolation transformer for this check). Use an AC voltmeter, having 5000 ohms per volt or more sensitivity.

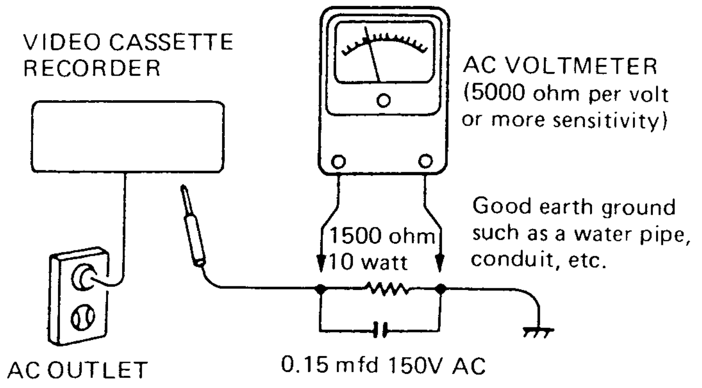
Connect a 1500 ohm 10 watt resistor, paralleled by a 0.15 mfd 150V AC capacitor between a known good earth ground (water pipe, conduit, etc.) and all exposed metal parts of cabinet (antennas, handle bracket, metal cabinet, screwheads, metal overlays, control shafts, etc.).

Measure the AC voltage across the 1500 ohm resistor. The test must be conducted with the AC switch on and then repeated with the AC switch off. The AC voltage indicated by the meter may not exceed 0.3 volts. A reading exceeding 0.3 volts indicates that a dangerous potential exists, the fault must be located and corrected.

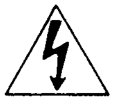
Repeat the above test with the VCR power plug reversed.

NEVER RETURN A VCR TO THE CUSTOMER WITHOUT TAKING NECESSARY CORRECTIVE ACTION.

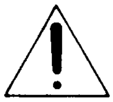
READING SHOULD NOT EXCEED 0.3V


VIDEO CASSETTE RECORDER
AC VOLTMETER (5000 ohm per volt or more sensitivity)
Good earth ground such as a water pipe, conduit, etc.
1500 ohm 10 watt
AC OUTLET
0.15 mfd 150V AC

Test all exposed metal.
Voltmeter Hook-up for Leakage Current Check



The lightning flash with arrowhead symbol, within an equilateral triangle, is intended to alert the user to the presence of uninsulated "dangerous voltage" within the product's enclosure that may be of sufficient magnitude to constitute a risk of electric shock to persons.



The exclamation point within an equilateral triangle is intended to alert the user to the presence of important operating and maintenance (servicing) instructions in the literature accompanying the appliance.

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1. OVERVIEW

1-1 VHS Format

The VHS format has been specified to assure correct operations of VHS type VCRs (Video Cassette Recorder) and to maintain interchangeability between VHS type cassette tapes. The format has specifications as described below.

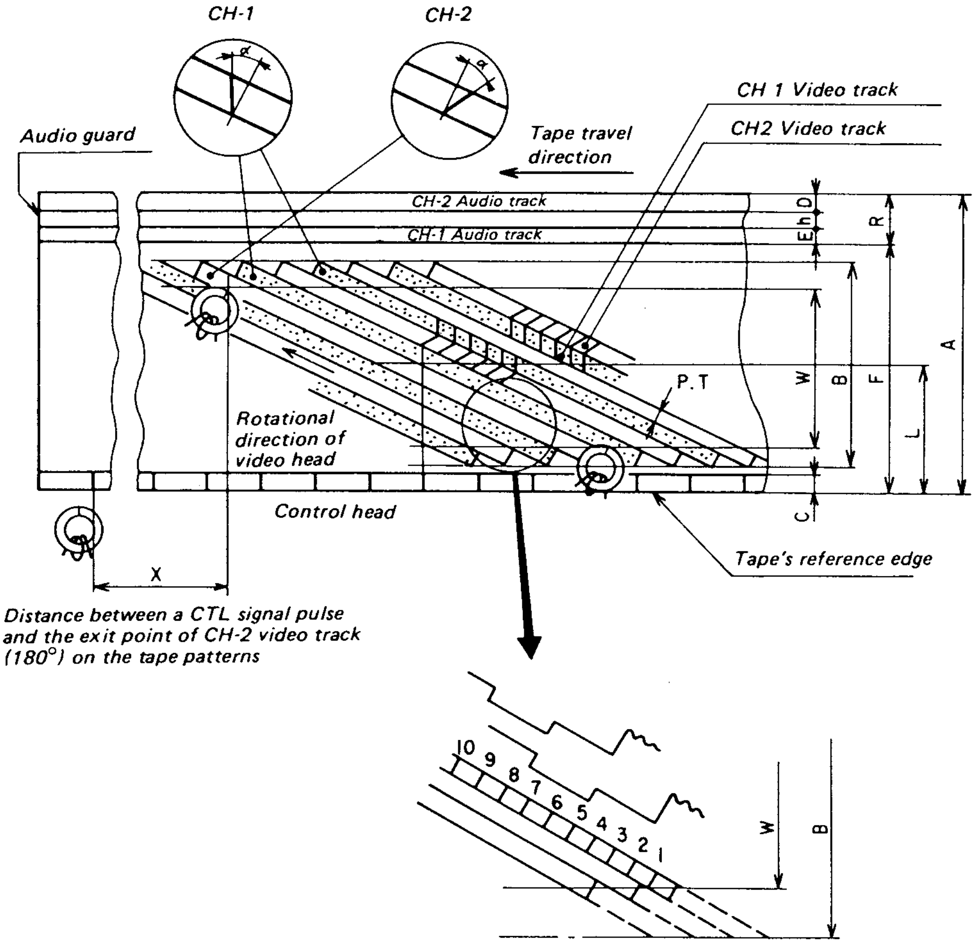
(1) Magnetic tape pattern

The tape pattern in the VHS format features:

- Guard bandless recording
- Azimuth angle of ±6 degrees, and
- "H"-alignment" (SP and EP modes)

1. Since a guard bandless recording system is employed a signal on an adjacent track will be reproduced in addition to the signal on a desired track if a tracking deviation is caused by any reason in the playback mode, thus causing undesirable crosstalk signals. Of the crosstalk signals, higher frequency components of a luminance FM signal can be removed by making use of azimuth loss effect of the heads. However, lower frequency components of the luminance FM signal can not be removed sufficiently because of poor azimuth loss effect to the lower frequencies.
2. To compensate the poor azimuth loss effect in the lower frequency range, a line correlation between tape patterns is introduced to remove the lower frequency components of the crosstalks. That is, each horizontal sync pulse is recorded so that it is always aligned with other sync pulses on the adjacent tracks. This is called "H-alignment".
3. Under this condition, crosstalks have frequencies close to a playback FM frequency of the main signal and develop considerably lower interference signal when they are demodulated.
4. Moreover, with the "H-alignment" established, skew distortion, which is caused when a video head traces on two or more tracks in a mode such as Que or Review, will cause almost no problem because of horizontal sync signals reproduced in the specific period.

   Fig. 1-1-1 shows magnetic tape patterns in the VHS format. Table 1-1-1 shows specifications for the patterns shown in Fig. 1-1-1.



Distance between a CTL signal pulse and the exit point of CH-2 video track (180°) on the tape patterns

Tape patterns viewed from magnetic material coated.

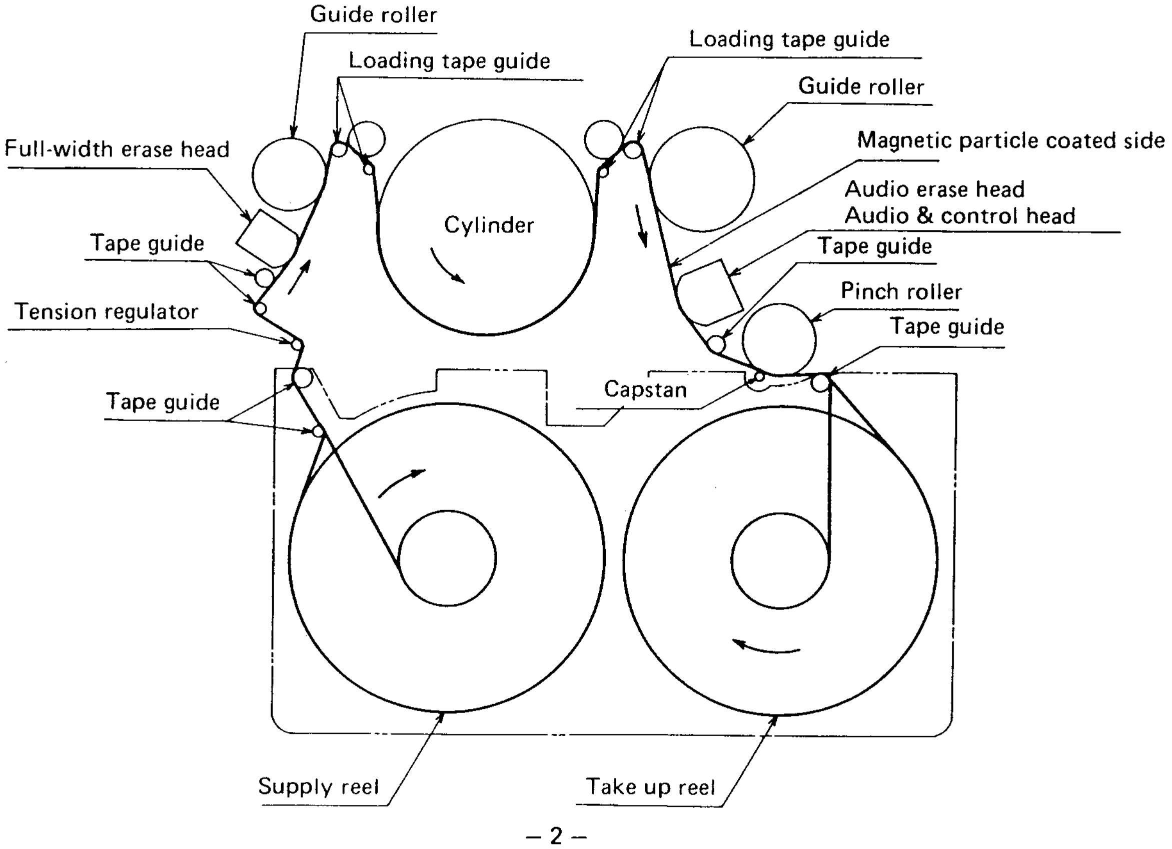
Fig. 1-1-1 Magnetic tape patterns

	Items		Specifications	Note
1.	(A) Tape width	mm	12.65 ± 0.01	
2.	(Vt) Tape travel speed	mm/sec	33.35 ± 0.5%	
3.	(ϕ) Cylinder diameter	mm	62 ± 0.01	Upper cylinder
4.	(Vh) Relative speed	m/sec	5.80	
5.	(P) Video track pitch	mm	0.058	
6.	(B) Video fullwidth	mm	10.60	
7.	(W) Video width	mm	10.07	
8.	(L) Video track center	mm	6.2	From reference edge of tape
9.	(T) Video track width	mm	0.058	
10.	(C) Control track width	mm	0.75	
11.	(R) Audio track width	mm	1.0	Single track
12.	(D) Audio track width	mm	0.35	CH-2 (R)
13.	(E) Audio track width	mm	0.35	CH-1 (L)
14.	(F) Audio track reference edge	mm	11.65	From reference edge of tape
15.	(h) Audio track guard width	mm	0.3	
16.	(o) Video track angle		5° 56′ 7.4″	During tape stopped
17.	(o) Video track angle		5° 58′ 9.9″	During tape running
18.	(ε) Video head azimuth angle		+6° ± 10′	
19.	(X) Position of audio and control heads	mm	79.244	
20.	Position of V-sync front porch		5 − 8H	Inside from lower end of W
21.	Back tension of tape		30 − 45 g	Beginning of tape wound cylinder entrance

Table 1-1-1 VHS specifications

Tape path

(This is not standardized, but shows a general arrangement in the VHS mechanism.)


Guide roller
Loading tape guide
Full-width erase head
Tape guide
Tension regulator
Tape guide
Cylinder
Loading tape guide
Guide roller
Magnetic particle coated side
Audio erase head
Audio & control head
Tape guide
Pinch roller
Tape guide
Capstan
Supply reel
Take up reel

(2) Video cassette

VHS type video cassettes have specifications as follows:

a. Video tape

Length: Determined by a length calculated by the following equation, depending upon nominal recording or playback time.

$$L = (2.02t + 3)^{+3}_{0}$$

Where L: Tape length (m)

t: Recording or playback time

L should be integer with all decimal points rounded-up

Width: 12.65 ±0.01mm

Allowance of width: Less than 6μm

Thickness: 20 +1, −2μm

Coercive force: Optimum recording current for 600 oersted (nominal) class should not differ from that of the reference tape.

b. Leader tape and trailer tape

Length: When recording or playback time
exceeds 60 min: 170 ±20mm
not exceeds 60 min: 150 ±20mm

Width: 12.65 ±0.03mm

Thickness: 40 +5, −25μm

Material: Polyester film

Light transmissivity: Higher than 50%

Splicing length: 12 – 19mm

Splicing clearance: 0 – 70μm

Splicing strength: Higher than 3 kg

c. Reel

Outside diameter: 89 ±0.2mm

Hub diameter: When recording or playback time
exceeds 60 min.: 26 ±0.15mm
not exceeds 60 min: 62 ±0.2mm
is less than 30 min.: 70 ±0.2mm allowable

Margin of wrapping: More than 1.5mm

d. Types and indication

Types of blank cassette

Type	Record or playback time	Length of video tape
T-120	120 min.	246 $^{+3}_{0}$ m
T-100	100 min.	205 $^{+3}_{0}$ m
T-90	90 min.	185 $^{+3}_{0}$ m
T-80	80 min.	165 $^{+3}_{0}$ m
T-60	60 min.	125 $^{+3}_{0}$ m
T-40	40 min.	84 $^{+3}_{0}$ m
T-30	30 min.	64 $^{+3}_{0}$ m
T-20	20 min.	44 $^{+3}_{0}$ m

e. Shape and dimensions of cassette

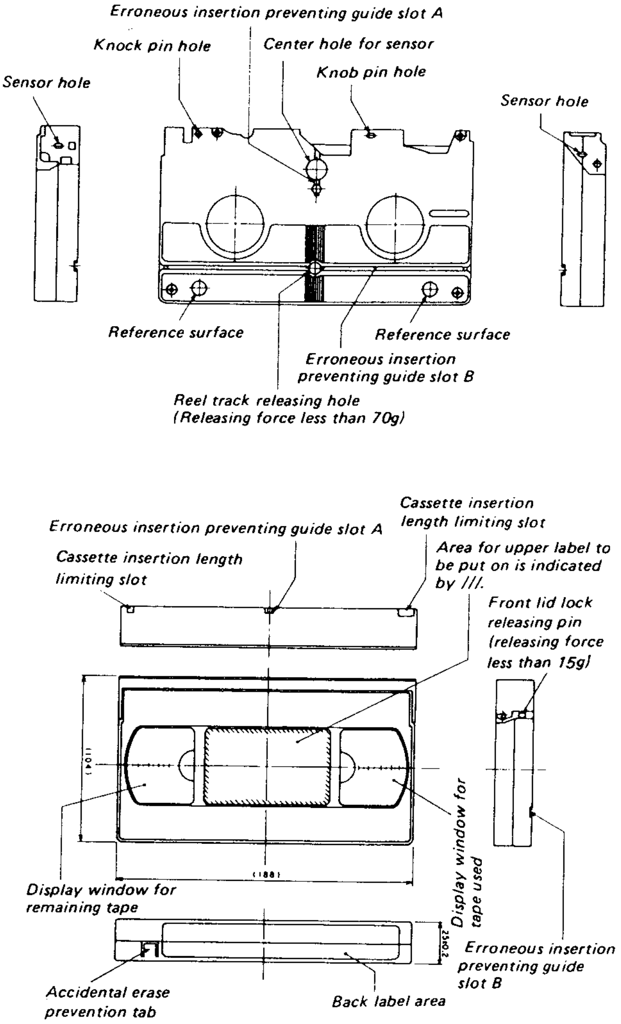

Erroneous insertion preventing guide slot A
Knock pin hole
Center hole for sensor
Knob pin hole
Sensor hole
Sensor hole
Reference surface
Reference surface
Erroneous insertion preventing guide slot B
Reel track releasing hole (Releasing force less than 70g)
Cassette insertion length limiting slot
Erroneous insertion preventing guide slot A
Cassette insertion length limiting slot
Area for upper label to be put on is indicated by ///.
Front lid lock releasing pin (releasing force less than 15g)
(104)
(188)
25±0.2
Display window for remaining tape
Display window for tape used
Erroneous insertion preventing guide slot B
Accidental erase prevention tab
Back label area

Fig. 1-1-2

f. Tape threading

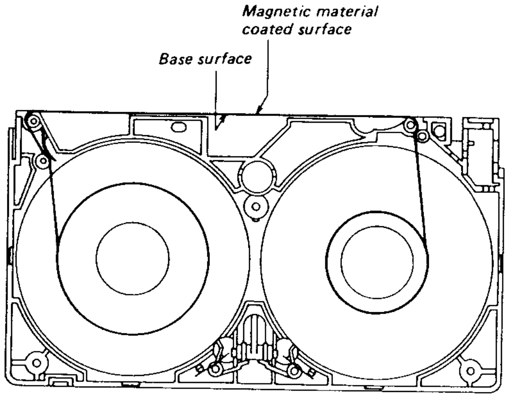

Magnetic material coated surface
Base surface

Fig. 1-1-3

(3) Recording system

a. Video signal recording system

Recording signal: Japan and U.S.A. standard TV signals (EIA and NTSC signals)

Luminance signals for black & white and color signals: FM recording

Carrier color signal: Direct recording of down converted every-line phase-shifted signal

b. Luminance signal record system

Pre-emphasis characteristic: T = 1.3 ±0.05 μsec
X = 4 ±0.3

FM carrier frequency: WHITE PEAK 4.4 ±0.1 MHz
SYNC TIP 3.4 MHz (reference value)

FM carrier frequency deviation: 1 ±0.1 MHz

White clip level: 160 ±10% (from sync tip)

Dark clip level: 40 ±10% (from sync tip)

(100% is assured from sync tip to white peak.)

FM Filter:

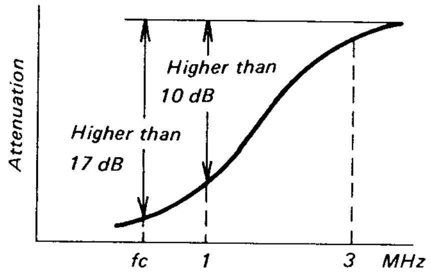


Fig. 1-1-4

Record current characteristics

FM signal record amplifier characteristic: For frequencies higher than 3.4 MHz . . . saturated optimum record current.

For currents at 2 MHz and 1 MHz. . . 3 dB ±1 dB and 6 dB ±1.5 dB referred to 0 dB current of 3.4 MHz, and flat response at frequencies less than 1 MHz.

Bandwidth of converted carrier color signal: Constant current response

Head current of FM signal: ±1.5 dB within optimum record current at 4 MHz

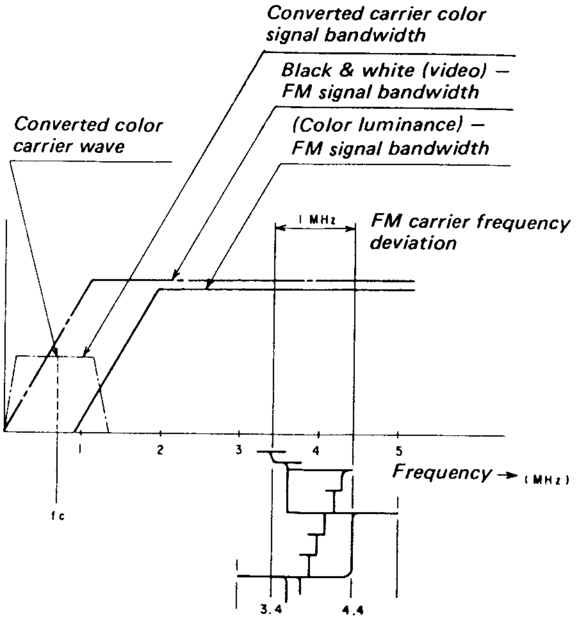
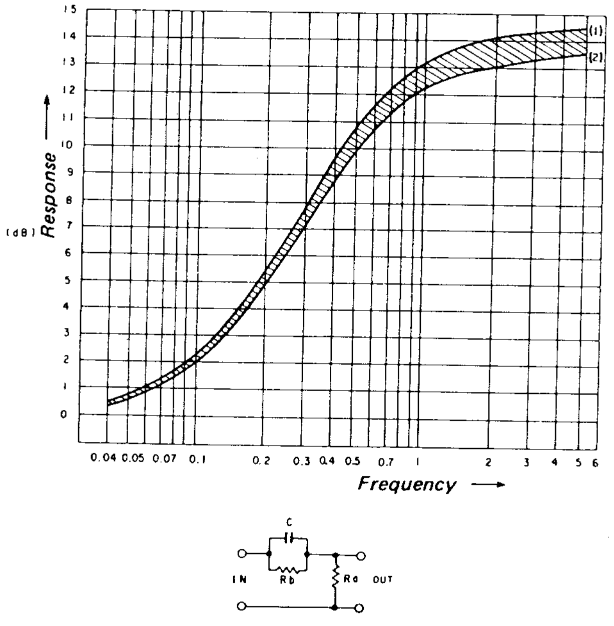

Converted carrier color signal bandwidth
Black & white (video) – FM signal bandwidth
Converted color carrier wave
(Color luminance) – FM signal bandwidth
1 MHz
FM carrier frequency deviation
1
2
3
4
5
Frequency → (MHz)
fc
3.4
4.4

Fig. 1-1-5 Recording signal spectrum



T : C · Rb : 1.3 μ sec ± 0.05 μ sec

$X = \frac{Rb}{Ra} = 4 \pm 0.3$

T = 1.35 μ sec } (1)
X = 4.3

T = 1.25 μ sec } (2)
X = 3.7

Fig. 1-1-6 Pre-emphasis characteristic

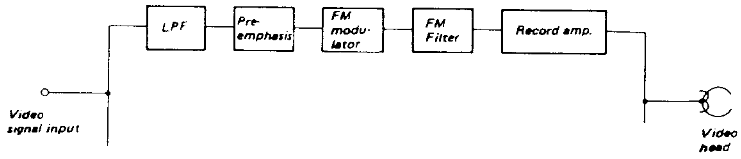

LPF
Pre-emphasis
FM modulator
FM Filter
Record amp.
Video signal input
Video head

Fig. 1-1-7 Basic block diagram of recording system

c. Color signal recording system

Fig. 1-1-8 shows a block diagram of a color recording system in the VHS system.

Converted carrier color signal frequency: fc = 40 x f_H (629,371 Hz)

(Where f_H stands for the horizontal sync frequency of an input video signal)

Record conversion carrier color signal phase:

CH-1: phase is advanced by 90° every one horizontal period. (6° rightward in head azimuth).

CH-2: phase is retarded by 90° every one horizontal period. (6° leftward in head azimuth).

Phase switching per line of the record carrier color signal is performed at a position equivalent to horizontal sync signal period or the front porch, and the burst phase should be free from any deterioration.

Spectrum arrangement of record conversion carrier color signal:

Locations of upper and lower side bands of the converted carrier color signals should be reversed each other from those of the original signal.

Recording level of converted carrier color signal: −7 – −10 dB (in playback output level) from the saturation level.

Burst signal pre-emphasis level: 6 dB ±0.5 dB

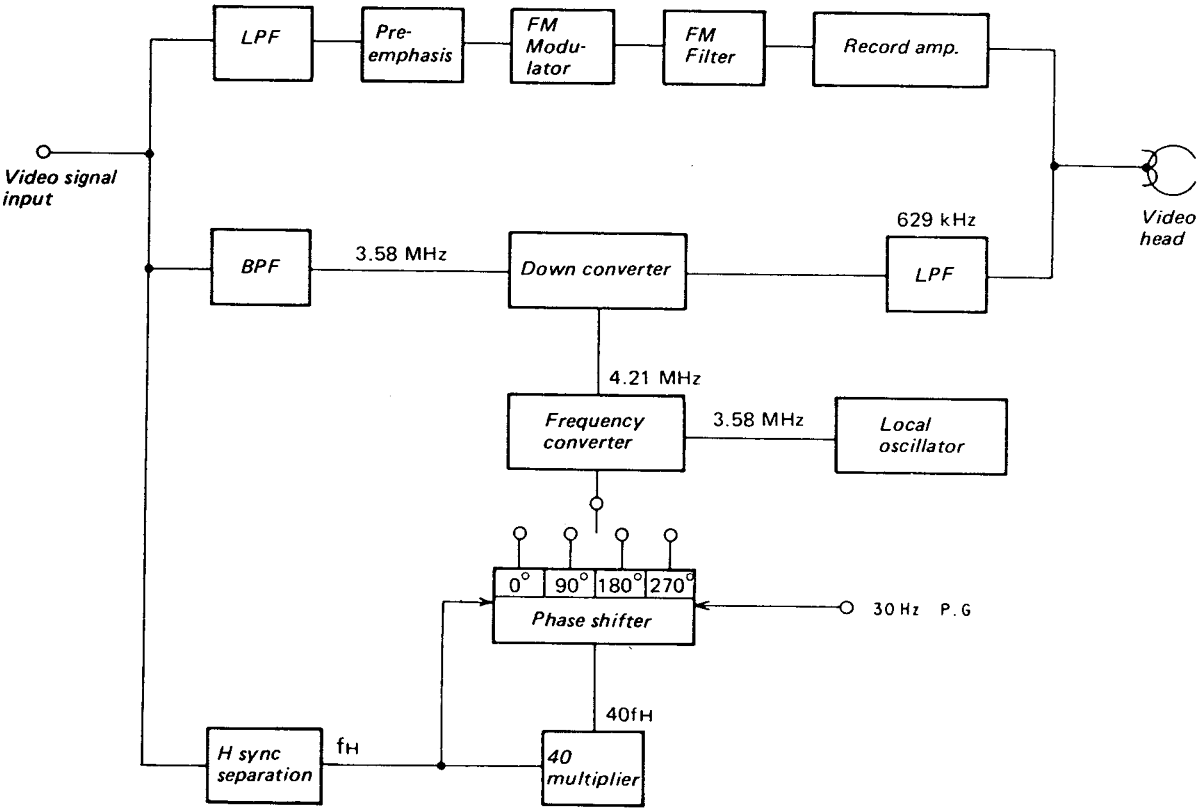

LPF
Pre-emphasis
FM Modulator
FM Filter
Record amp.
Video signal input
Video head
629 kHz
BPF
3.58 MHz
Down converter
LPF
4.21 MHz
Frequency converter
3.58 MHz
Local oscillator
0°
90°
180°
270°
Phase shifter
30 Hz P.G
40fH
H sync separation
fH
40 multiplier

Fig. 1-1-8

(4) Recording format of control signal

Recording level: The control signal should be recorded with a level higher than a saturation recording level on the control track.

Correlations among waveform, polarities of control signal and video heads should be as follows:

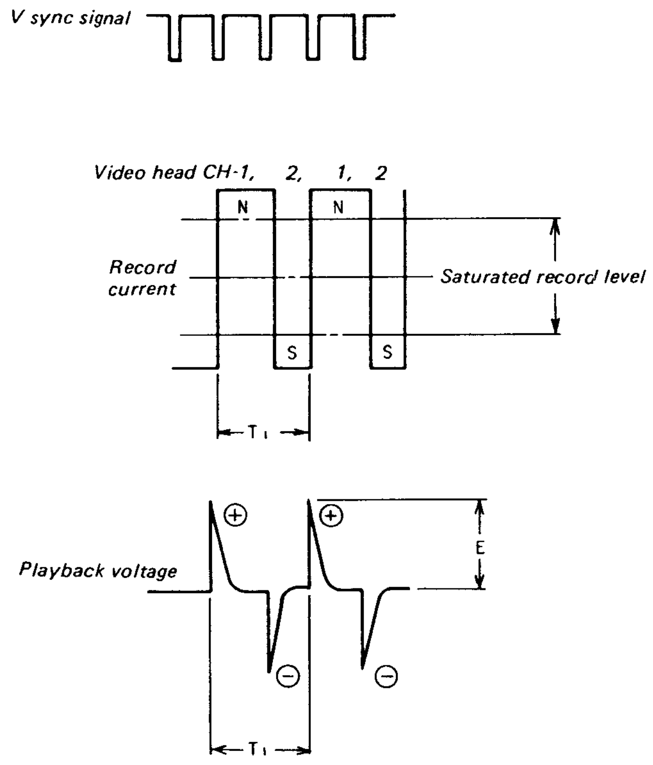

V sync signal
Video head CH-1, 2, 1, 2
N
N
Record current
Saturated record level
S
S
T₁
Playback voltage
⊕
⊕
E
⊖
⊖
T₁

Fig. 1-1-9

(5) Recording format of audio signals

Recording current response for audio signals should be such a response that gives flat a response when the recorded signals are reproduced with a playback system having the response shown in Fig. 1-1-10.

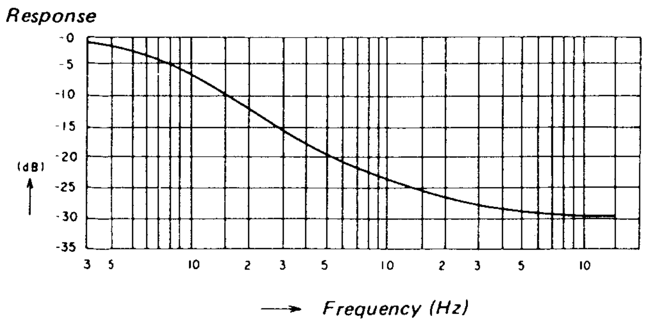


Fig. 1-1-10

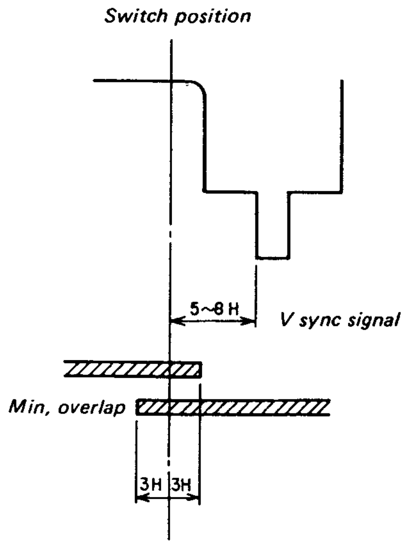

Switch position
5~8 H
V sync signal
Min, overlap
3H
3H

Fig. 1-1-11

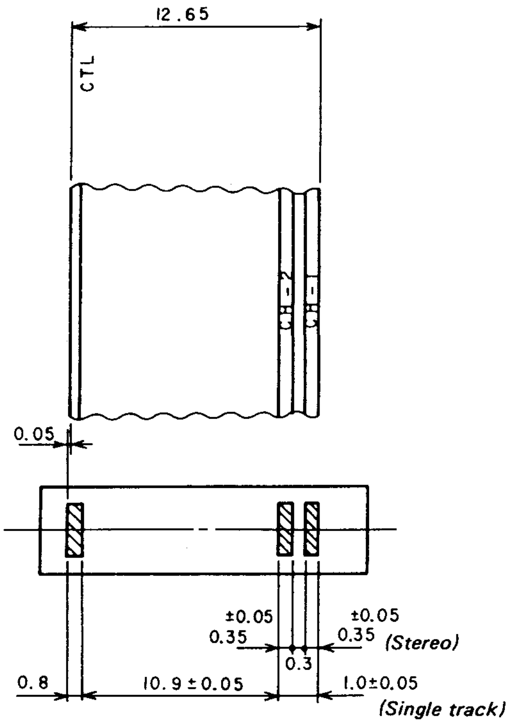

12.65
CTL
CH-2
CH-1
0.05
±0.05
0.35
±0.05
0.35
(Stereo)
0.3
0.8
10.9 ± 0.05
1.0±0.05
(Single track)

Fig. 1-1-12 Audio and control head

Note: Gaps for a control head and an audio head should be aligned in line.

2. OPERATION THEORY, MECHANISM

2-1 Outline

2-1-1 Mechanism system configuration

Fig. 2-1-1 shows a diagram of mechanical system configuration consisting of functional blocks. In addition to this a tape transport adjusting mechanism is included.

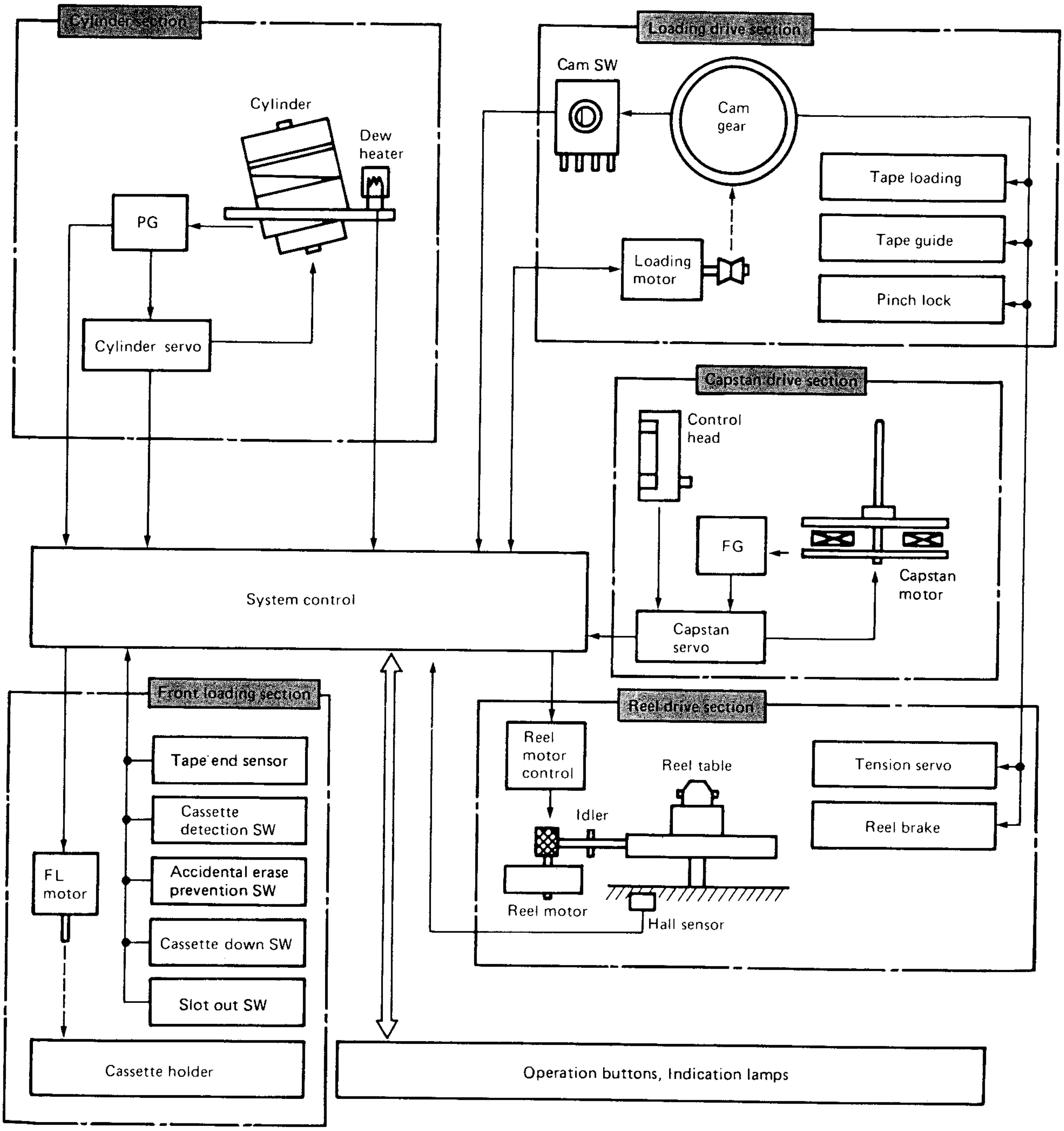

Cylinder section
Cylinder
Dew heater
PG
Cylinder servo
Loading drive section
Cam SW
Cam gear
Tape loading
Tape guide
Pinch lock
Loading motor
Capstan drive section
Control head
FG
Capstan motor
Capstan servo
System control
Front loading section
Tape end sensor
Cassette detection SW
Accidental erase prevention SW
Cassette down SW
Slot out SW
FL motor
Cassette holder
Reel drive section
Reel motor control
Reel table
Idler
Reel motor
Hall sensor
Tension servo
Reel brake
Operation buttons, Indication lamps

Fig. 2-1-1 Mechanical System Diagram

2-1-2 Description on each functional block

(1) Front loading

The front loading mechanism consists of the following main parts.

Mechanical Parts	● Cassette holder
	● Guide bracket
	● Slot mechanism
	● Door control mechanism
	● Cassette dual insertion protection mechanism
	● Cassette lid opening mechanism
Electrical Parts	● FL motor
	● Cassette insertion detection switches (L, R)
	● Cassette down detection switch
	● Accidental erase prevention
	● Slot out detection switch
	● Tape end detection switch

(2) Loading drive

Loading drive operations are performed in the following orders.

1 The loading motor rotates the cam gear.
2 The rotating cam gear moves the pinch lock lever, logic slider and the brake slider, thus setting each part of mechanisms to a specified mode.
3 The loading motor also rotates the loading ring and moves the S, T sliders, thereby wrapping a tape around the cylinder or unwrapping the tape from the cylinder.

(3) Reel drive

1 The reel motor rotates the T-reel table or the S-reel table through an idler.
It is determined by swing direction of the idler (depending upon rotating direction of the reel motor) that which one of the reel tables is driven.
2 In the playback mode, the reel motor is driven by a constant current source to develop a constant torque.
The band brake which is wrapped around the S-reel table applies a specified tension to the tape.
3 Detection of rotating reel tables is performed by magnets mounted under the reel tables and hall sensors.
4 In the FF or REW mode, rotation detectors (hall sensors) detect a wound position of a tape and control the voltage to the reel motor.

(4) Capstan

1) A direct drive system is employed in the capstan drive system.
Speed control in the playback mode is conducted by a FG servo system and a phase control circuit using control pulses.

(5) Cylinder

The cylinder is driven by a built-in direct drive type motor.

Rotating speed control of the cylinder is conducted by detecting rotating speed of the rotor with a PG head.

To prevent dew condensation on the cylinder surface, a dew heater is provided. The heater operates when the main power is turned off.

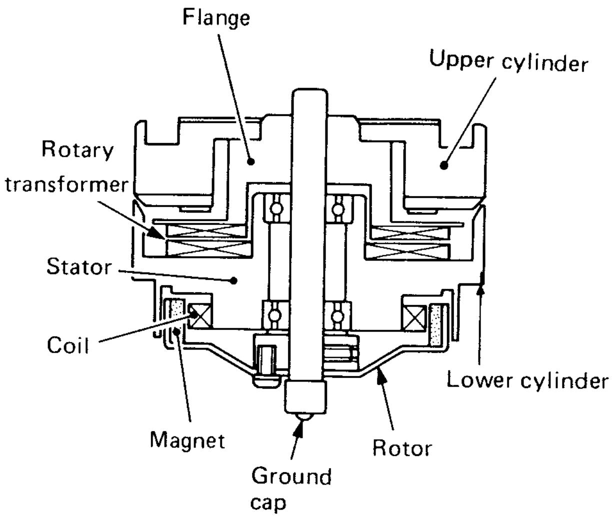


Fig. 2-1-2 Structure of Cylinder

(6) Tape transport adjustment mechanism

This adjustment mechanism consists of following parts:

1. Nos. 3 and 8 guide posts
2. S- and T- guide rollers
3. FE and ACE heads
4. No. 9 guide post

The purpose of the transport adjustment is as follows:

- To obtain a playback RF signal envelope with fine linearity.
- To adjust azimuth control position to assure good interchangeability of cassette tapes.

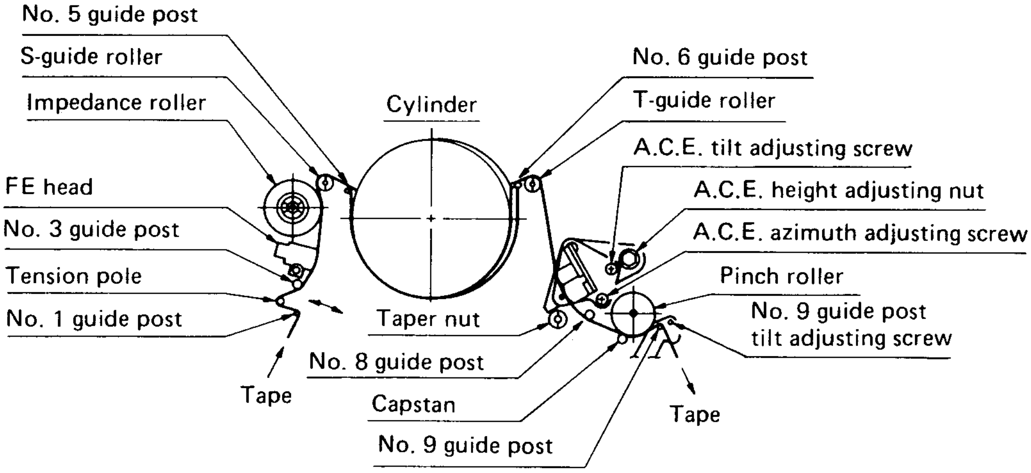

No. 5 guide post
S-guide roller
Impedance roller
Cylinder
FE head
No. 3 guide post
Tension pole
No. 1 guide post
Tape
No. 6 guide post
T-guide roller
A.C.E. tilt adjusting screw
A.C.E. height adjusting nut
A.C.E. azimuth adjusting screw
Pinch roller
No. 9 guide post tilt adjusting screw
Taper nut
No. 8 guide post
Capstan
No. 9 guide post
Tape

Fig. 2-1-3 Tape transport adjustment location

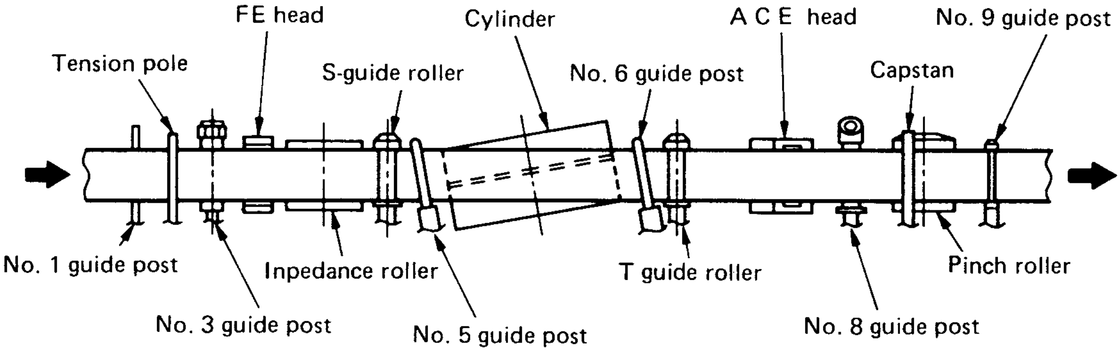

FE head
Cylinder
A C E head
No. 9 guide post
Tension pole
S-guide roller
No. 6 guide post
Capstan
No. 1 guide post
Inpedance roller
T guide roller
Pinch roller
No. 3 guide post
No. 5 guide post
No. 8 guide post

Fig. 2-1-4 Tape path diagram

2-2 Cam Gear Operation

2-2-1 Cam gear and operation of each mechanism

(1) Four cams A – D are provided on one disc. (Fig. 2-2-3)

(2) These cams control the main brakes, soft brakes, pinch roller, band brakes, etc. through the logic slider, brake slider, and the pinch lock lever. (Fig. 2-2-2)

(3) The cam gear rotates the loading ring which in turn moves the S.T sliders. (Fig. 2-2-1)

(4) Fig. 2-2-1 shows shapes of the cams and position for each mode of operation.
Table 2-2-1 also shows operation modes and their timings.

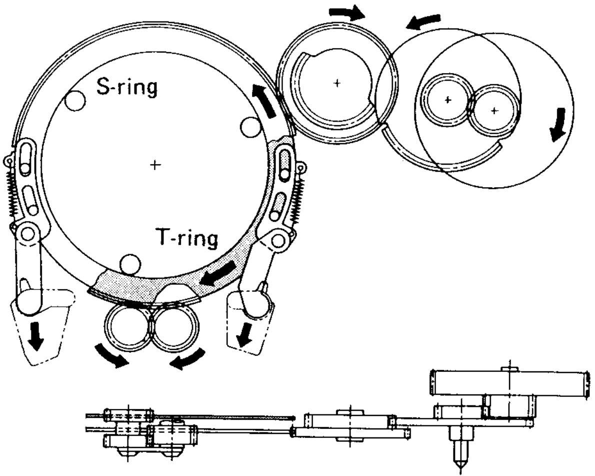

S-ring
T-ring
Cam A, B, C

Fig. 2-2-1

Table 2-2-1
Timing table for cam gear and each mode

Mode	Operation guide	Slider position	Cam position	Cam SW position
FF/REW	FF, FF Short, Rewind	A	①	I
Stop	Stop, Cassette eject, Rewind short, Loading, Unloading	A	②	II
Play	Play, Still Rec, Pause Slow playback FF playback	B	③	V
Pause	Timer operation standby Rec → Stop	B	④	VII
Review	Review	B	⑤	VII

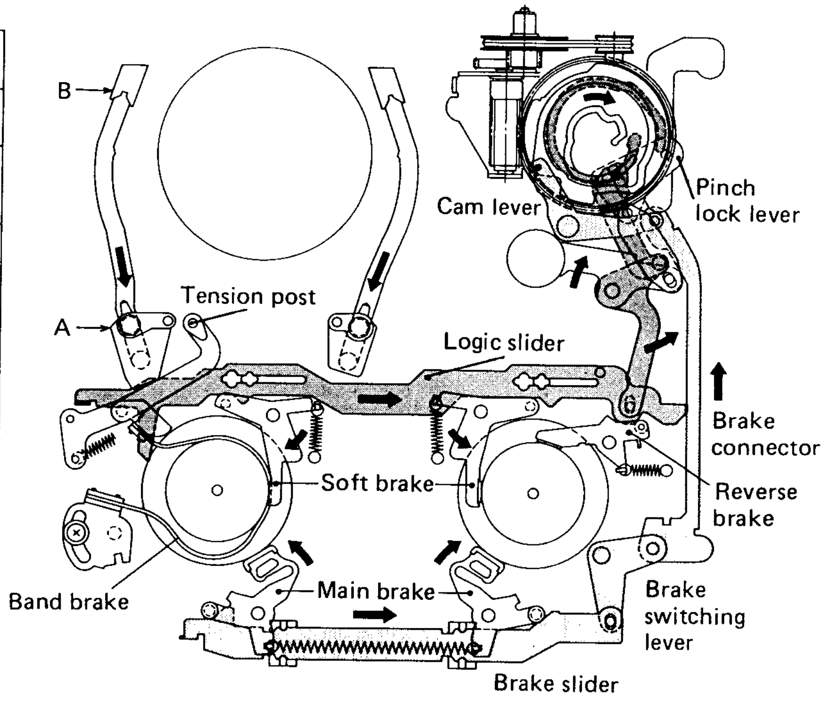
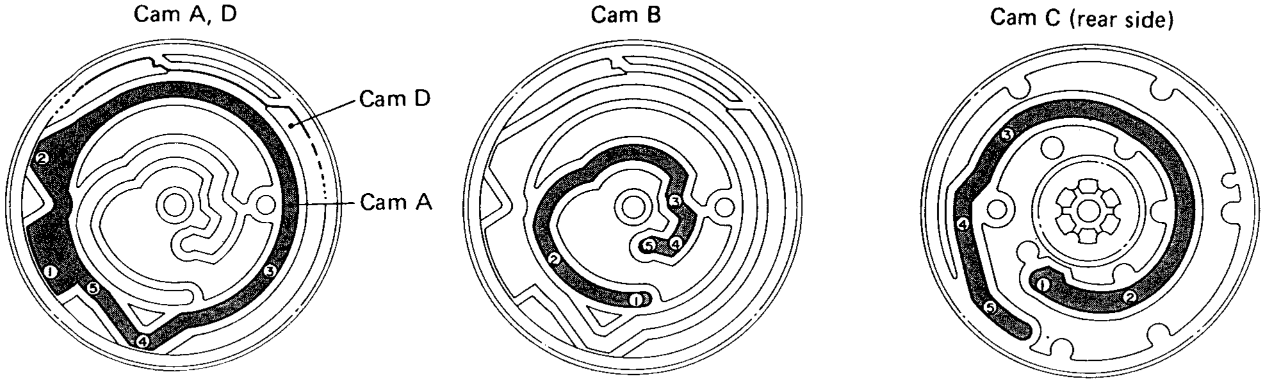

B
A
Tension post
Cam lever
Pinch lock lever
Logic slider
Brake connector
Soft brake
Reverse brake
Band brake
Main brake
Brake switching lever
Brake slider

Fig. 2-2-2


Cam A, D
Cam D
Cam A
Cam B
Cam C (rear side)
①
②
③
④
⑤

Cam A and cam D control the main brakes through cam lever, brake connector, brake switching lever and brake slider.

Cam B controls pinch roller through pinch lock lever.

Cam C controls soft brakes, band brakes and reverse brakes through logic slider.

Fig. 2-2-3

2-2-2 Cam switch drive

(1) Cam switches function to convert each mode of the mechanisms into electrical signals and transfer them to the microcomputer.

(2) The cam switches are rotated in synchronization with the cam gear by the loading motor and each mode signal is created in relation to the angle of the cam rotated.

(3) IC601 controls IC602 to drive the loading motor in forward or reverse direction for setting the cam to a desired mode position.
Fig. 2-2-4 shows forward rotation modes of the cam.

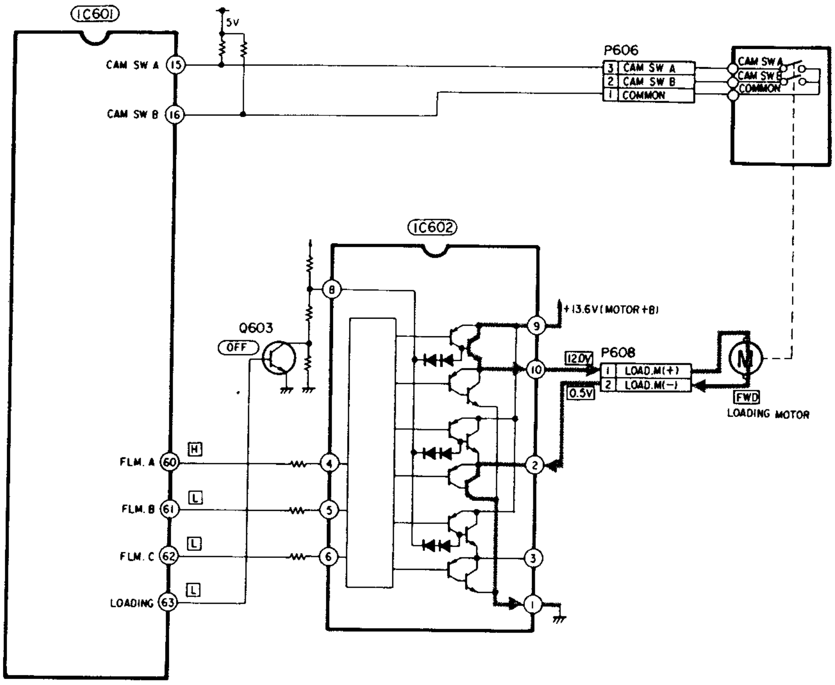

IC601
5V
CAM SW A 15
CAM SW B 16
P606
3 CAM SW A
2 CAM SW B
1 COMMON
CAM SW A
CAM SW B
COMMON
IC602
8
+13.6V (MOTOR+B)
9
Q603
OFF
10
12.0V
P608
1 LOAD.M(+)
2 LOAD.M(−)
0.5V
M
FWD
LOADING MOTOR
FLM. A 60 H
FLM. B 61 L
FLM. C 62 L
LOADING 63 L
4
5
6
2
3
1

Fig. 2-2-4 Loading motor drive (FF rotation)

Mode	IC601				Loading motor
	⑥⓪	⑥①	⑥②	⑥③	
Stop	H	H	H	L	Stop
Cam rotates forwardly (Loading)	H	L	L	L H	FW rotation (11.5V) FW rotation (8.5V)
Cam rotate reversely (Unloading)	H	L	H	L H	RV rotation (11.5V) RV rotation (8.5V)

FW: Forward
RV: Reverse

2-2-3 Cam control

(1) The loading motor rotates and moves the cam gear, thus setting a mechanical mode.

(2) Cam gear positions corresponding to various modes, cam switches, and mechanical system operations are given in the cam control chart.

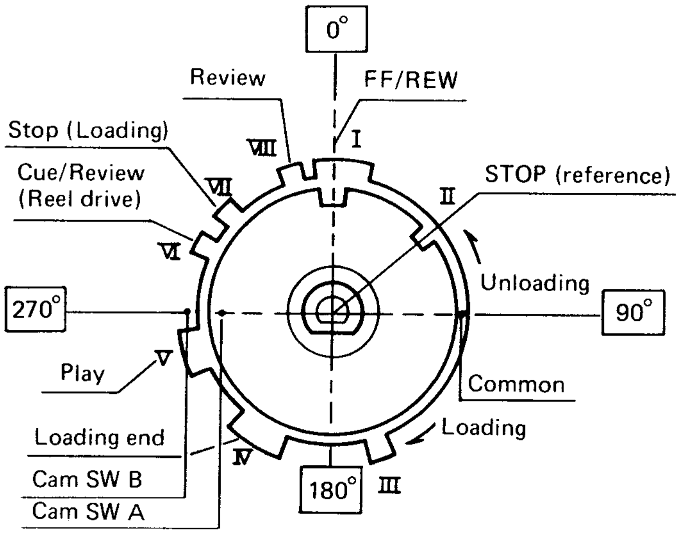

0°
Review
FF/REW
I
Stop (Loading)
VIII
STOP (reference)
Cue/Review
(Reel drive)
VII
II
VI
Unloading
270°
90°
Play
V
Common
Loading
Loading end
IV
Cam SW B
180°
III
Cam SW A

Fig. 2-2-5 Shape of cam switch

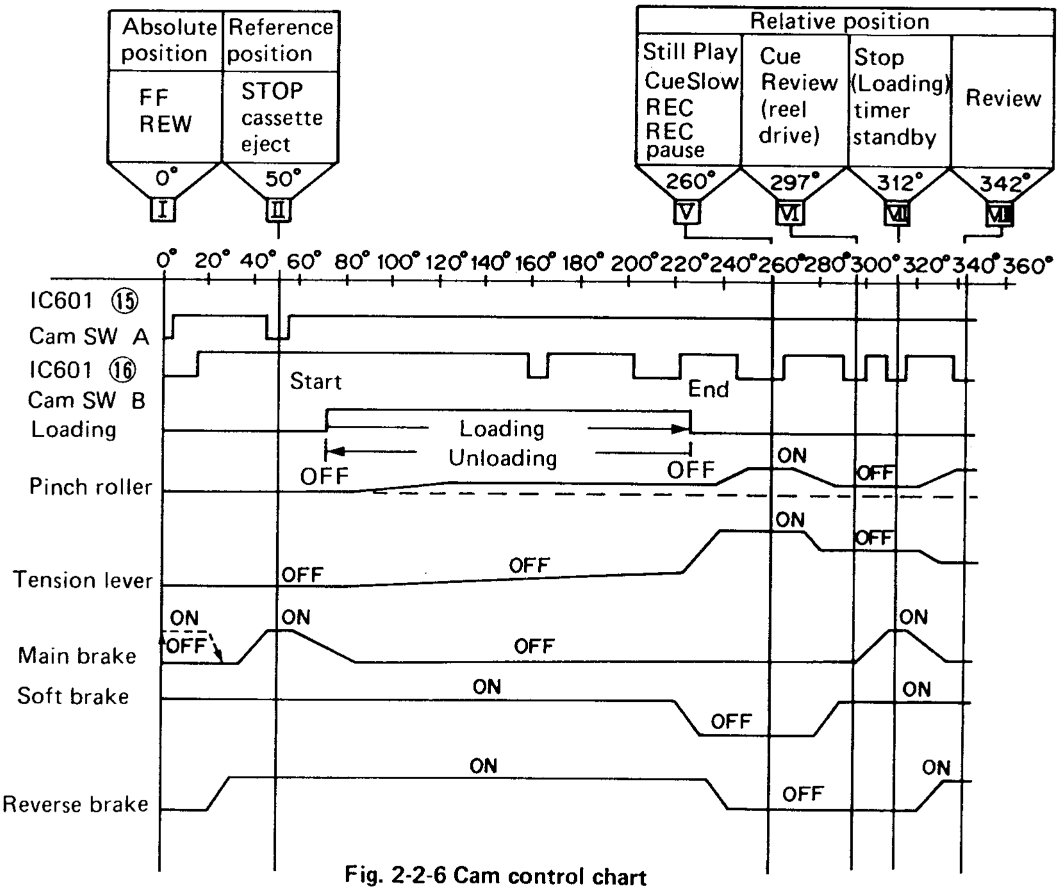


Fig. 2-2-6 Cam control chart

3. DESCRIPTION ON EACH MODE OF OPERATION

3-1 Front Loading

3-1-1 Slot-in operation

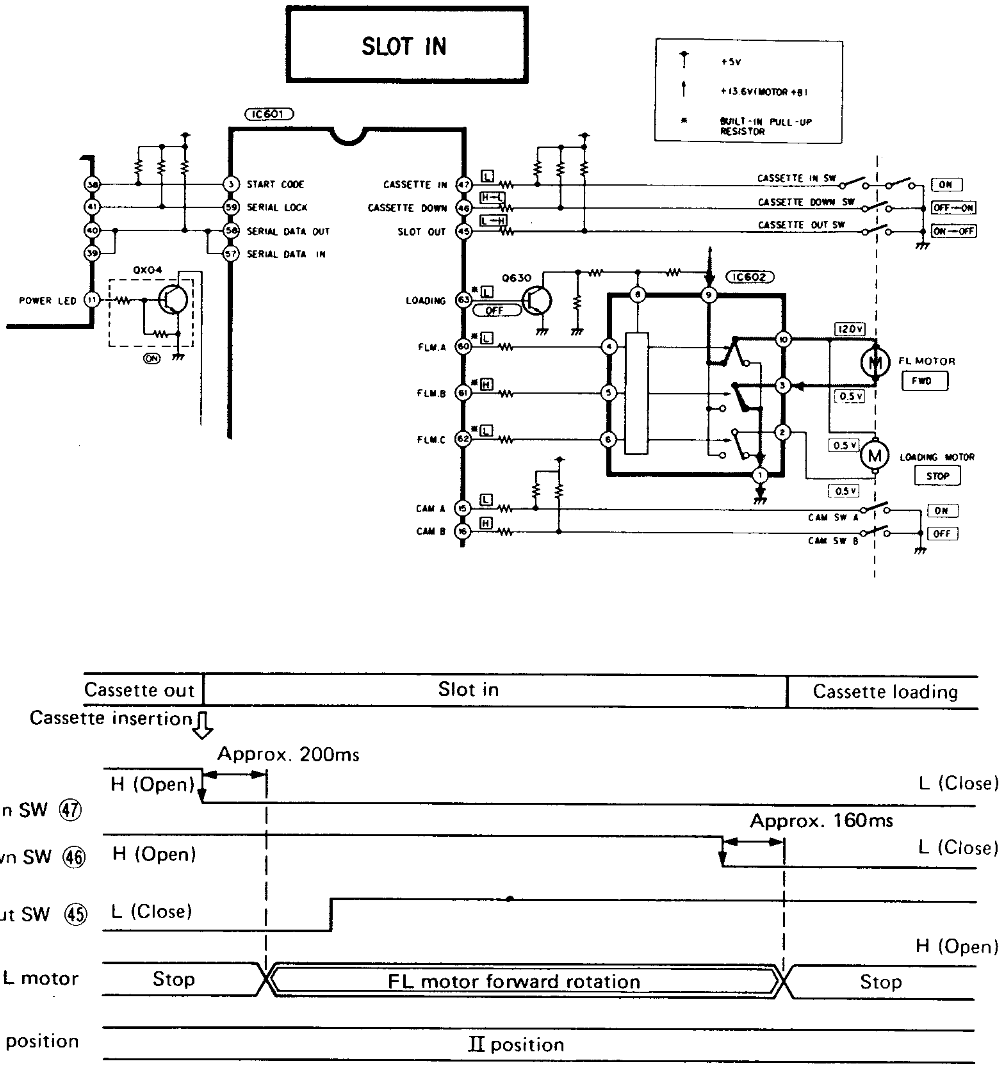

SLOT IN
+5V
+13.6V(MOTOR +B)
* BUILT-IN PULL-UP RESISTOR
IC601
START CODE
SERIAL LOCK
SERIAL DATA OUT
SERIAL DATA IN
POWER LED
QX04
ON
CASSETTE IN
CASSETTE DOWN
SLOT OUT
L
H→L
L→H
CASSETTE IN SW
CASSETTE DOWN SW
CASSETTE OUT SW
ON
OFF→ON
ON→OFF
Q630
IC602
LOADING
OFF
FLM.A
FLM.B
FLM.C
12.0V
0.5V
FL MOTOR
FWD
LOADING MOTOR
STOP
CAM A
CAM B
CAM SW A
CAM SW B
ON
OFF
Cassette out
Slot in
Cassette loading
Cassette insertion
Approx. 200ms
H (Open)
L (Close)
Cassette in SW ㊼
Approx. 160ms
Cassette down SW ㊻
H (Open)
L (Close)
Slot out SW ㊺
L (Close)
H (Open)
FL motor
Stop
FL motor forward rotation
Stop
Cam position
II position

Fig. 3-1-1 Slot in operation

(1) When a cassette is loaded into the cassette holder, two cassette detection switches mounted under the cassette holder are pressed by the bottom case of the cassette and closed. (IC601 controls IC602 to rotate the FL motor in foward direction.) (Fig. 3-1-2)

(2) The motor rotates in direction shown by the arrow (clockwise direction viewed from front side) with the two left and right cassette detection switches in operation.
The rotational energy of the motor is transferred to the arm gear L through the coupling, worm gear, worm wheel, arm gear R and the left and right drive gears, and the arm gear L moves the cassette holder horizontally.
(Refer to Fig. 3-1-3)

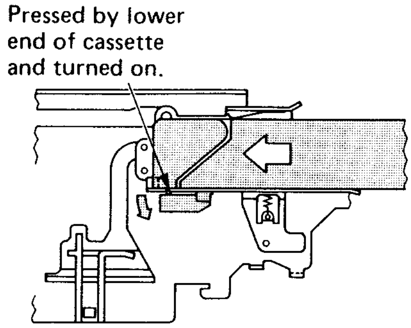

Pressed by lower end of cassette and turned on.

Fig. 3-1-2

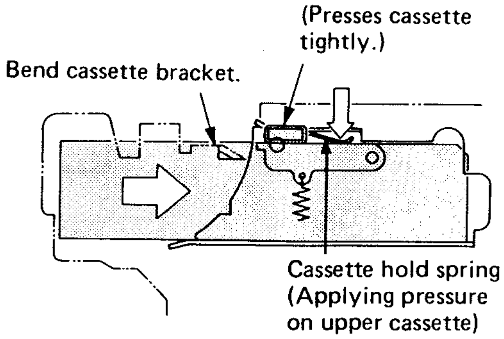

(Presses cassette tightly.)
Bend cassette bracket.
Cassette hold spring (Applying pressure on upper cassette)

Fig. 3-1-4

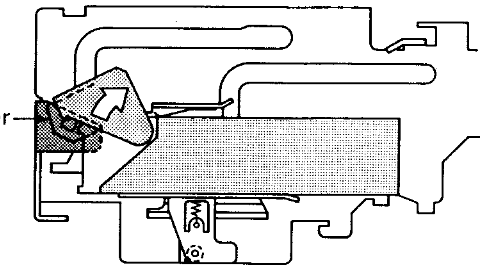

Cassette lid opener

Fig. 3-1-5

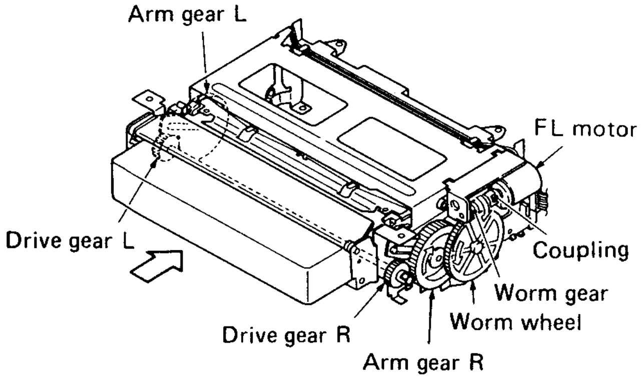

Arm gear L
FL motor
Drive gear L
Coupling
Worm gear
Worm wheel
Drive gear R
Arm gear R

Fig. 3-1-3

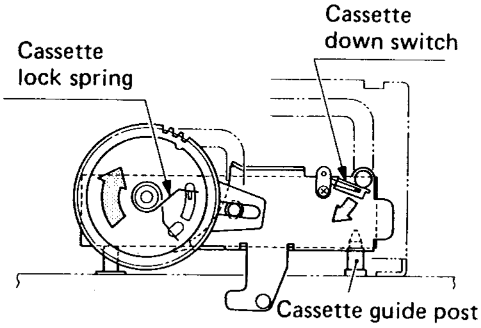

Cassette down switch
Cassette lock spring
Cassette guide post

Fig. 3-1-6

(3) The cassette loaded in the cassette holder is, first, held in a place by two cassette hold springs (strip) provided on left and right sides of the holder re-enforcement plates, thus preventing the cassette from its positional deviation at the starting period.
Motion of the cassette holder unlatches both left and right cassette levers from their hooks provided on the guide bracket and allows the cassette to rotate in the direction being pressed, thus holding the cassette more tightly and preventing positional deviation of the cassette due to the cassette lid opener.
(Fig. 3-1-4)

(4) In the last stage of the cassette holder's horizontal motion, the cassette lid is engaged with the cassette opener and opened widely as the cassette holder moves down.

(5) When the cassette is mounted on the cassette guide posts, the cassette down switch turns on.
The slot motor continues to rotate for approx. 160 msec after the above operation and the cassette is pressed by the left and right cassette lock springs and stopped. (Fig. 3-1-6)

3-1-2 Slot-out operation

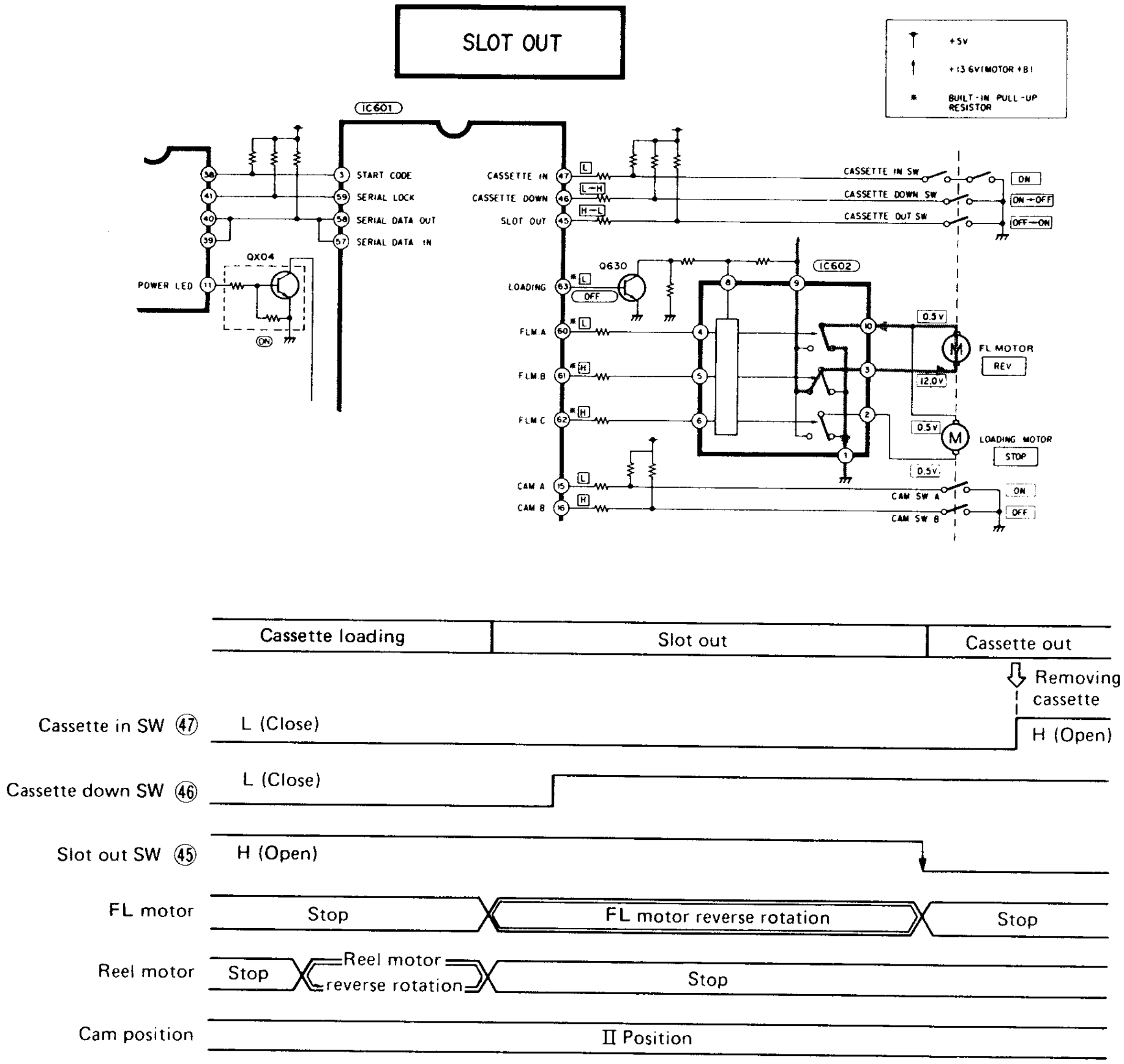

SLOT OUT
IC601
38
41
40
39
3 START CODE
59 SERIAL LOCK
58 SERIAL DATA OUT
57 SERIAL DATA IN
QX04
POWER LED 11
ON
CASSETTE IN 47
CASSETTE DOWN 46
SLOT OUT 45
L
L→H
H→L
CASSETTE IN SW
CASSETTE DOWN SW
CASSETTE OUT SW
ON
ON→OFF
OFF→ON
+5V
+13.6V(MOTOR +B)
* BUILT-IN PULL-UP RESISTOR
Q630
IC602
LOADING 63
*L
OFF
FLM A 60
*L
FLM B 61
*H
FLM C 62
*H
0.5V
12.0V
FL MOTOR
REV
0.5V
LOADING MOTOR
STOP
0.5V
CAM A 15
L
CAM B 16
H
CAM SW A
CAM SW B
ON
OFF
Cassette loading
Slot out
Cassette out
Removing cassette
Cassette in SW ㊼
L (Close)
H (Open)
Cassette down SW ㊻
L (Close)
Slot out SW ㊺
H (Open)
FL motor
Stop
FL motor reverse rotation
Stop
Reel motor
Stop
Reel motor reverse rotation
Stop
Cam position
II Position

Fig. 3-1-7 Slot out operation

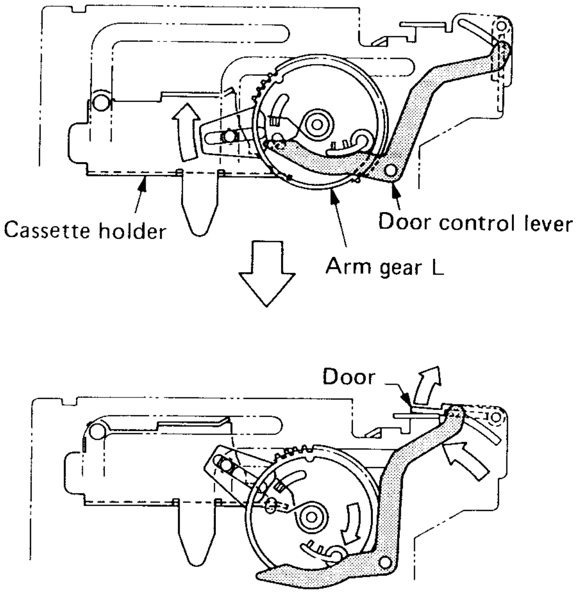


Fig. 3-1-8

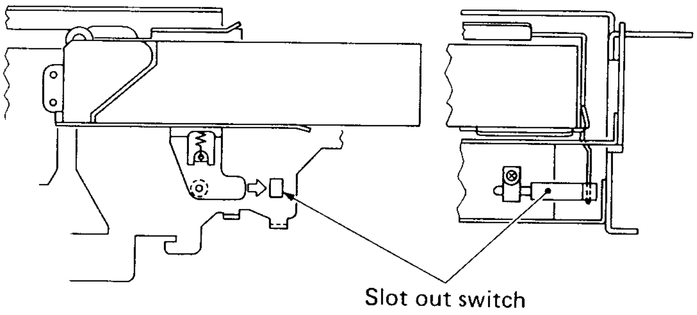


Fig. 3-1-9

(1) The loading motor rotates and sets the cam gear to the stop mode (position II) and actuates the main brakes for the reel tables.

(2) IC601 controls IC603 so that the reel motor rotates in opposite direction for approx. 1 sec to remove tape slack. Then, IC601 also controls IC603 and rotates the FL motor in reverse direction.

(3) While the cassette holder is moving upward, the door control lever rotatively moves along the cam surface of the arm gear and the door opens. (Fig. 3-1-8)

(4) The cassette holder horizontally moves and reaches close to the stop position, the slot-out switch is turned on by the lower right end of the cassette holder. (Fig. 3-1-9)

3-2 Stop Mode

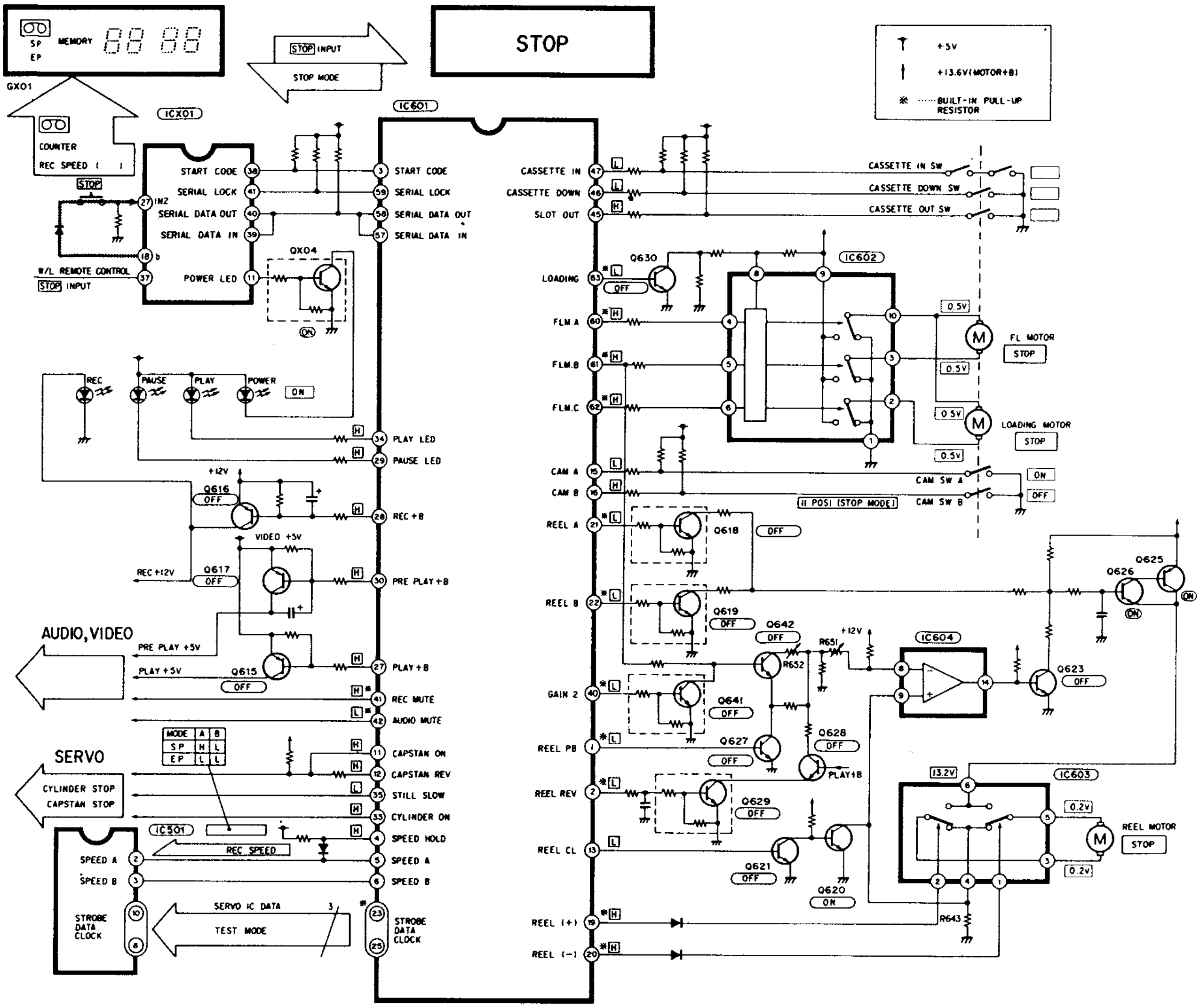

SP
EP
MEMORY
GXO1
COUNTER
REC SPEED ( )
STOP INPUT
STOP MODE
STOP
+5V
+13.6V(MOTOR+B)
※ ······BUILT-IN PULL-UP RESISTOR
ICXO1
STOP
IN2
START CODE
SERIAL LOCK
SERIAL DATA OUT
SERIAL DATA IN
b
W/L REMOTE CONTROL
STOP INPUT
POWER LED
QXO4
ON
REC
PAUSE
PLAY
POWER
ON
+12V
Q616
OFF
VIDEO +5V
REC +12V
Q617
OFF
AUDIO, VIDEO
PRE PLAY +5V
PLAY +5V
Q615
OFF
MODE A B
SP H L
EP L L
SERVO
CYLINDER STOP
CAPSTAN STOP
IC501
REC SPEED
SPEED A
SPEED B
STROBE
DATA
CLOCK
SERVO IC DATA
TEST MODE
3
IC601
START CODE
SERIAL LOCK
SERIAL DATA OUT
SERIAL DATA IN
PLAY LED
PAUSE LED
REC +B
PRE PLAY +B
PLAY +B
REC MUTE
AUDIO MUTE
CAPSTAN ON
CAPSTAN REV
STILL SLOW
CYLINDER ON
SPEED HOLD
SPEED A
SPEED B
STROBE
DATA
CLOCK
CASSETTE IN
CASSETTE DOWN
SLOT OUT
LOADING
FLM.A
FLM.B
FLM.C
CAM A
CAM B
REEL A
REEL B
GAIN 2
REEL PB
REEL REV
REEL CL
REEL (+)
REEL (−)
CASSETTE IN SW
CASSETTE DOWN SW
CASSETTE OUT SW
Q630
OFF
IC602
0.5V
FL MOTOR
STOP
LOADING MOTOR
STOP
CAM SW A
CAM SW B
II POSI (STOP MODE)
ON
OFF
Q618
OFF
Q619
OFF
Q642
OFF
R651
R652
+12V
IC604
Q641
OFF
Q627
OFF
Q628
OFF
PLAY+B
Q629
OFF
Q621
OFF
Q620
ON
Q626
ON
Q625
ON
Q623
OFF
13.2V
IC603
0.2V
REEL MOTOR
STOP
R643

Fig. 3-2-1

(1) The cam gear is in the stop mode (position II). Under this condition, the cylinder motor, capstan motor, and the reel motor are also stopped.

(2) Each part of the mechanism is set as follows:
   1 The T- and S- sliders are set in unloading condition.
   2 The pinch roller is away from the capstan.
   3 The tension lever is stored on the reel table side. That is, the band brake is released and the back tension is released.
   4 The T- and S-main brakes, T- and S-soft brakes and the reverse brakes are being actuated.

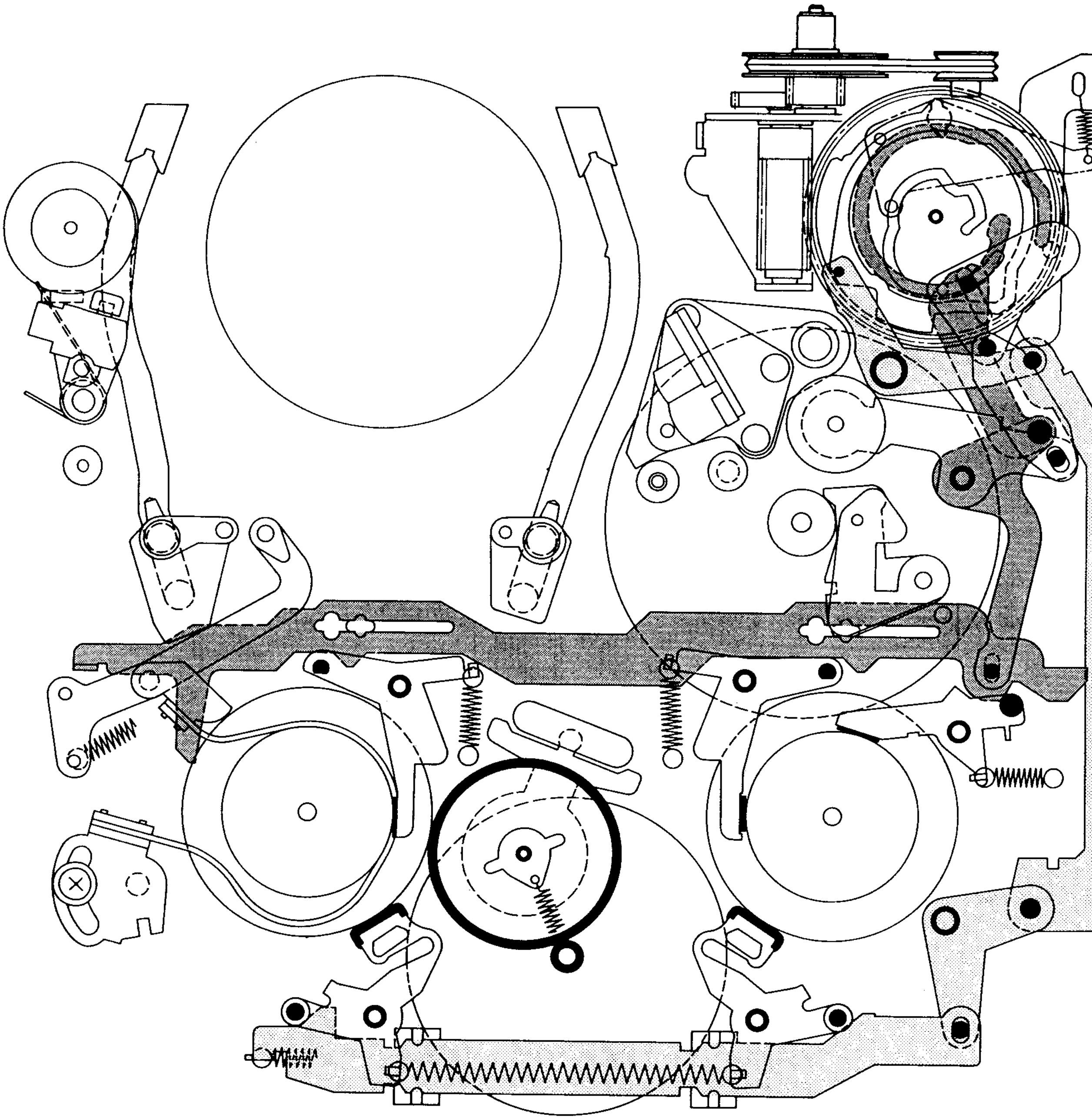


Fig. 3-2-2

3-3 FF/REW Mode (From Stop Mode)

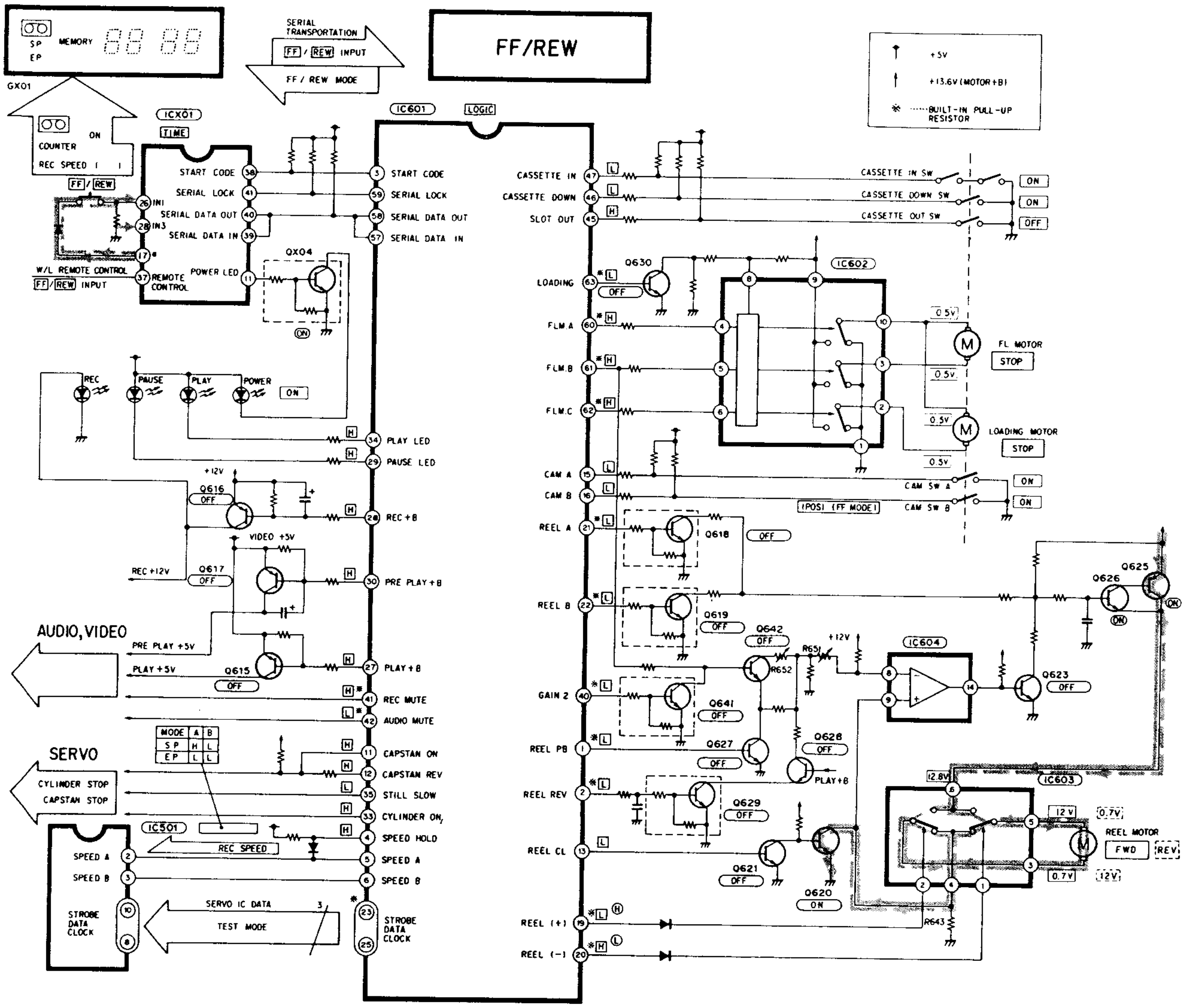

SP
MEMORY
EP
GX01
ON
COUNTER
REC SPEED
SERIAL TRANSPORTATION
FF / REW INPUT
FF / REW MODE
FF/REW
+5V
+13.6V (MOTOR+B)
BUILT-IN PULL-UP RESISTOR
ICX01
TIME
IC601
LOGIC
START CODE
SERIAL LOCK
SERIAL DATA OUT
SERIAL DATA IN
INI
IN3
W/L REMOTE CONTROL
FF/REW INPUT
REMOTE CONTROL
POWER LED
QX04
ON
REC
PAUSE
PLAY
POWER
ON
PLAY LED
PAUSE LED
+12V
Q616
OFF
REC+B
VIDEO +5V
REC+12V
Q617
OFF
PRE PLAY+B
AUDIO,VIDEO
PRE PLAY +5V
PLAY+5V
Q615
OFF
PLAY+B
REC MUTE
AUDIO MUTE
SERVO
MODE A B
SP H L
EP L L
CYLINDER STOP
CAPSTAN STOP
CAPSTAN ON
CAPSTAN REV
STILL SLOW
CYLINDER ON
SPEED HOLD
SPEED A
SPEED B
IC501
REC SPEED
SPEED A
SPEED B
STROBE DATA CLOCK
SERVO IC DATA
TEST MODE
STROBE DATA CLOCK
CASSETTE IN
CASSETTE DOWN
SLOT OUT
CASSETTE IN SW
CASSETTE DOWN SW
CASSETTE OUT SW
ON
ON
OFF
LOADING
Q630
OFF
IC602
FLM A
FLM B
FLM C
0.5V
FL MOTOR
STOP
0.5V
0.5V
LOADING MOTOR
STOP
0.5V
CAM A
CAM B
CAM SW A
CAM SW B
ON
ON
(POS I (FF MODE))
REEL A
Q618
OFF
Q625
Q626
ON
ON
REEL B
Q619
OFF
Q642
OFF
+12V
R651
R652
IC604
GAIN 2
Q641
OFF
Q623
OFF
REEL PB
Q627
OFF
Q628
OFF
PLAY+B
REEL REV
Q629
OFF
12.8V
IC603
12V
0.7V
REEL MOTOR
FWD
REV
REEL CL
Q621
OFF
Q620
ON
0.7V
12V
REEL (+)
REEL (-)
R643

Fig. 3-3-1

(1) When the FF button is pushed in the stop mode, ICX01 transfers the FF input signal serially to IC601 to set the FF mode.

(2) IC601 controls IC602 and rotates the loading motor in reverse direction. (direction ①)

(3) The cam gear rotates (①–⑥), the brake slider starts to move and releases the T- and S-main brakes (⑦–⑭).

The logic slider also moves and releases the reverse brake. (⑮ – ㉒)

(4) When the cam gear is set to the FF mode (position I), the loading motor stops.

IC601 controls IC603 which in turn drives the reel motor with a constant voltage. Then the idler contacts the T-reel table and transfers rotational energy, thus winding the tape.

(5) In the REW mode, the reel motor rotates in reverse direction, and the idler contacts the S-reel table, thus rewinding the tape.

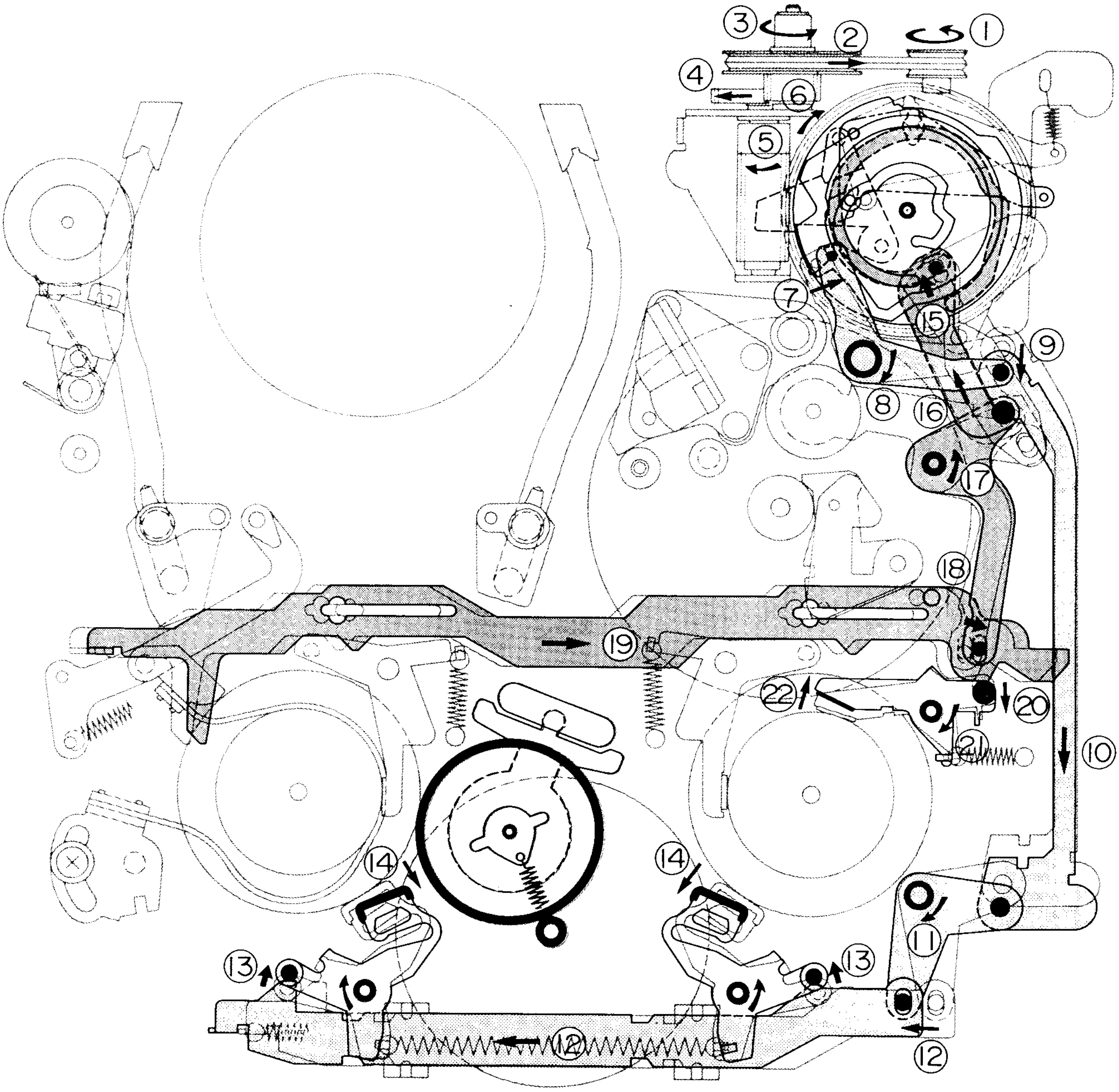


Fig. 3-3-2

(6) The cylinder motor and the capstan motor are in stop condition.

Note: Operation from FF/REW mode to STOP mode

- During positions I – II, the terminal voltage of the reel motor is maintained at approx. 1.5V to prevent the tape from slacking.
- When the loading motor rotates in forward direction, the lock lever actuates and the T- and S-main brakes are immediately actuated.

3-4 Playback System Mode

3-4-1 Loading mode

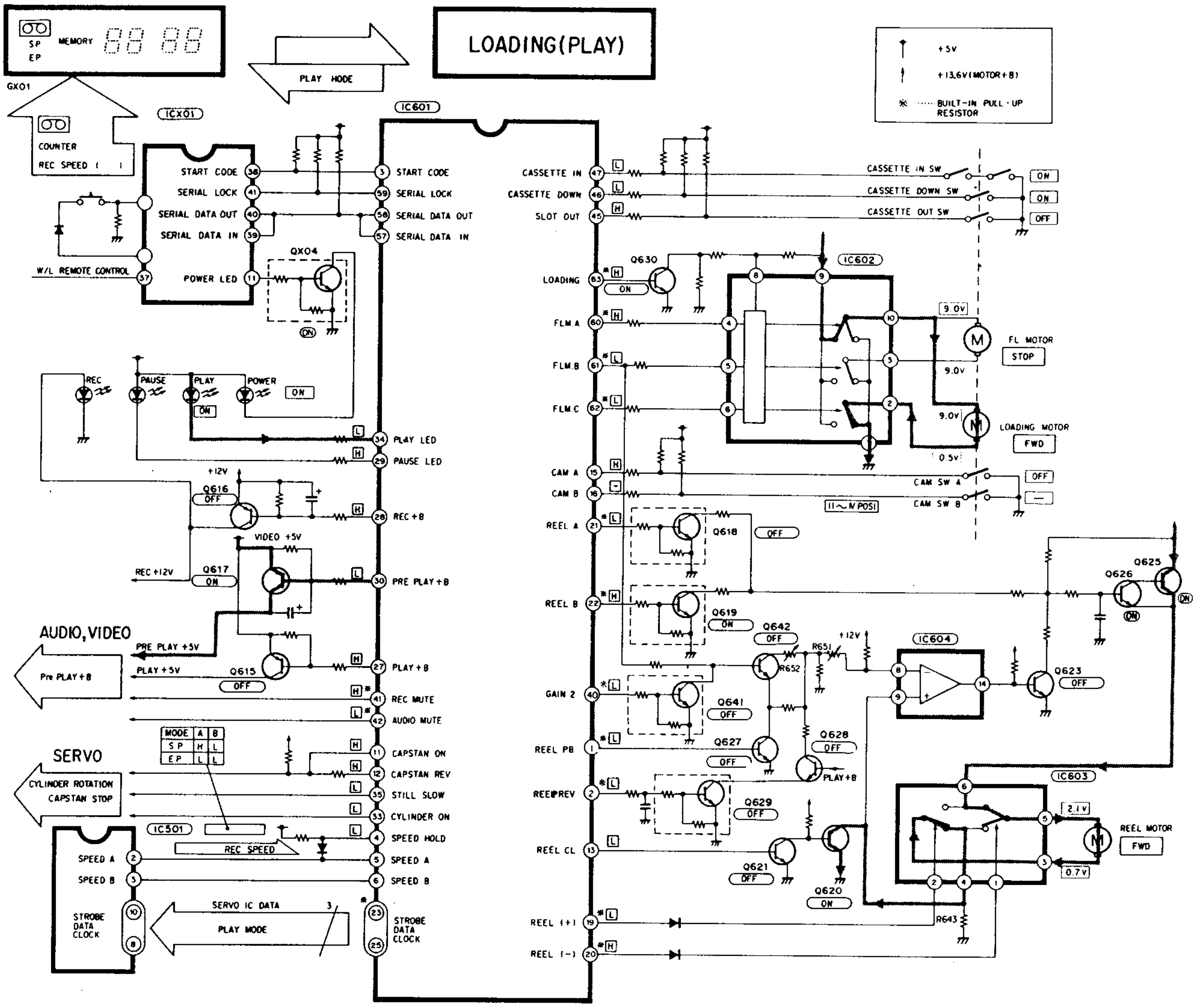

SP
MEMORY
EP
GX01
COUNTER
REC SPEED ( )
PLAY MODE
LOADING(PLAY)
+5V
+13.6V(MOTOR+B)
※ ····· BUILT-IN PULL-UP RESISTOR
ICX01
IC601
START CODE 38
SERIAL LOCK 41
SERIAL DATA OUT 40
SERIAL DATA IN 39
W/L REMOTE CONTROL 37
POWER LED 11
QX04
ON
3 START CODE
59 SERIAL LOCK
56 SERIAL DATA OUT
57 SERIAL DATA IN
CASSETTE IN 47 L
CASSETTE DOWN 46 L
SLOT OUT 45 H
CASSETTE IN SW
CASSETTE DOWN SW
CASSETTE OUT SW
ON
ON
OFF
Q630
IC602
LOADING 63 H
ON
FLM.A 60 H
FLM.B 61 L
FLM.C 62 L
9.0V
FL MOTOR
STOP
9.0V
9.0V
LOADING MOTOR
FWD
0.5V
REC
PAUSE
PLAY
POWER
ON
ON
L 34 PLAY LED
H 29 PAUSE LED
+12V
Q616
OFF
H 28 REC+B
VIDEO +5V
REC +12V
Q617
ON
L 30 PRE PLAY+B
CAM A 15 H
CAM B 16 -
CAM SW A
CAM SW B
OFF
II～IV POSI
REEL A 21 L
Q618
OFF
REEL B 22 H
Q619
ON
Q642
OFF
R651
R652
+12V
IC604
Q625
Q626
ON
ON
Q623
OFF
AUDIO, VIDEO
PRE PLAY +5V
Pre PLAY+B
PLAY +5V
Q615
OFF
H 27 PLAY+B
H 41 REC MUTE
L 42 AUDIO MUTE
GAIN 2 40 L
Q641
OFF
MODE A B
SP H L
EP L L
SERVO
CYLINDER ROTATION
CAPSTAN STOP
H 11 CAPSTAN ON
H 12 CAPSTAN REV
L 35 STILL SLOW
L 33 CYLINDER ON
L 4 SPEED HOLD
5 SPEED A
6 SPEED B
IC501
REC SPEED
SPEED A 2
SPEED B 3
STROBE DATA CLOCK
SERVO IC DATA
3
PLAY MODE
23 STROBE DATA CLOCK 25
REEL PB 1 L
Q627
OFF
Q628
OFF
PLAY+B
REEL REV 2 L
Q629
OFF
REEL CL 13 L
Q621
OFF
Q620
ON
IC603
2.1V
0.7V
REEL MOTOR
FWD
R643
REEL (+) 19 L
REEL (-) 20 H

Fig. 3-4-1

(1) When the PLAY button is pushed in the stop mode, ICX01 serially transfers the playback input signal to IC601 to set the playback mode.

(2) IC601 and IC603 make the reel motor rotate in forward direction and the idler moves toward the T-reel table side. After that, the output at pin ㉒ turns to "H" level and this makes Q619 on, keeping the motor terminal voltage at approx. 1.5V so that the T-reel table does not rotate in reverse direction. (Since the reverse brake is actuated, no tape is wound.)

(3) Next, the loading motor rotates in forward direction. At the same time the cam gear rotates. (① – ⑥). Then the brake slider moves and releases the T- and S-main brakes. (⑦ – ⑭)

(4) When the loading motor rotates in forward direction, the loading ring and the loading gear make the T- and S-sliders move along the loading guide. (⑮)
In the loading mode (position II – IV), pin (63) of IC601 goes "H" level, and this sets the motor terminal voltage to 8,5V, thus controlling moving speed of the T- and S-sliders.
When the cam gear exceeds position II, the cylinder motor starts to run.
At the same time, the tension lever also moves toward the No. 1 guide.
Furthermore, the pinch lock lever moves and the pinch roller moves toward the capstan side. (⑯ – ⑱)

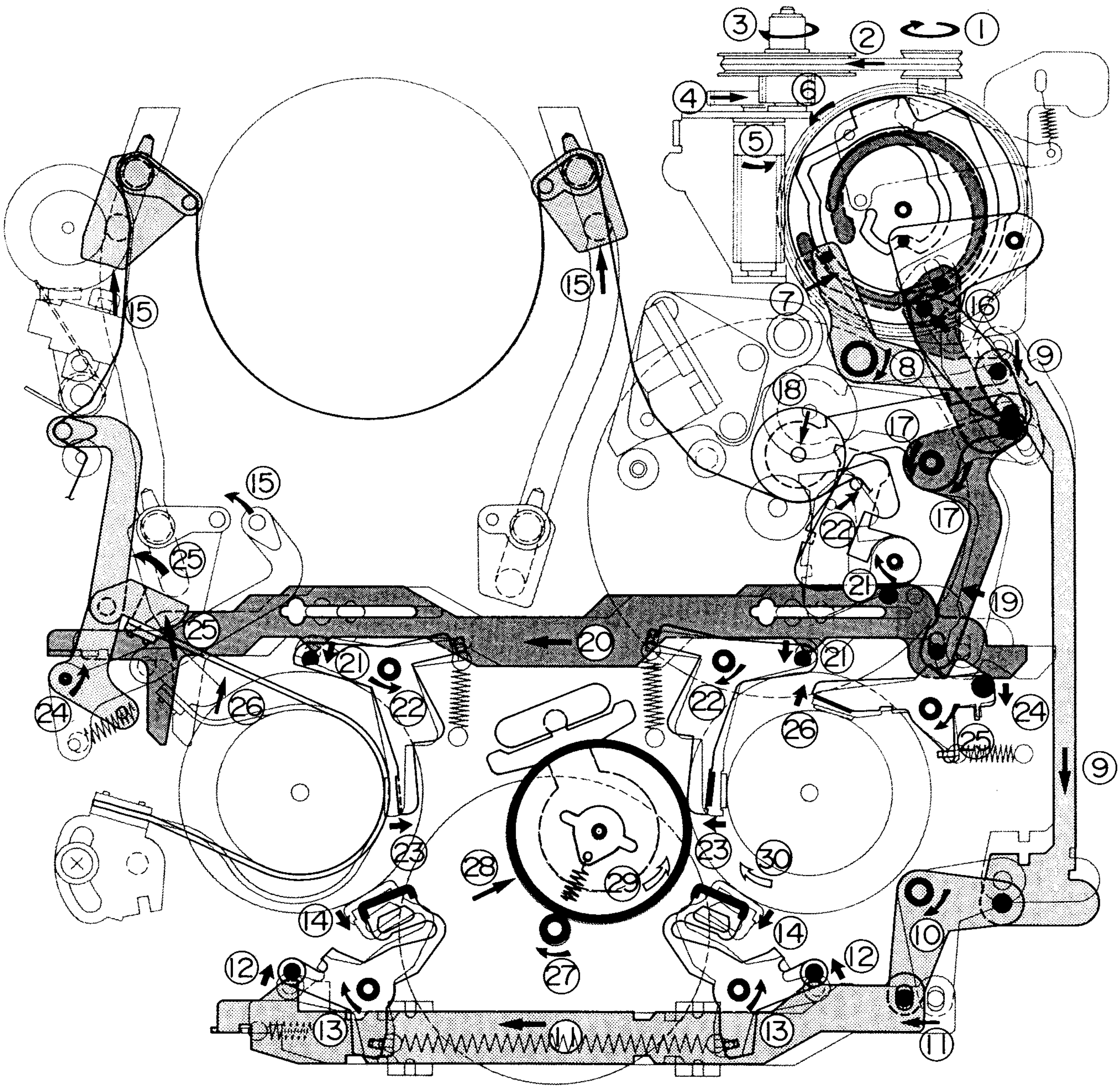


Fig. 3-4-2

(5) When the cam gear reaches the position IV, pin (63) of IC601 develops "L" level, and the terminal voltage of the loading motor rises to approx. 11.5V. Then, the T- and S-sliders are fixed to the cylinder base.
At the same time, the logic slider moves, the T- and S-soft brakes are released, (⑲ – ㉓), and the reverse brake is also released, (㉔ – ㉖).
The tension lever moves, furthermore, toward the No. 1 guide side, the band brake actuates, and the back tension mechanism functions.
No. 9 guide lever also moves and No. 9 guide is setup. (㉕ – ㉖)

(6) The pinch roller engages with the capstan with a specified pressure. (⑯ – ⑱)

(7) When the cam gear exceeds the playback mode (position V), the loading motor rotates in reverse direction and when the cam returns to the position V, the motor stops.

3-4-2 Playback mode

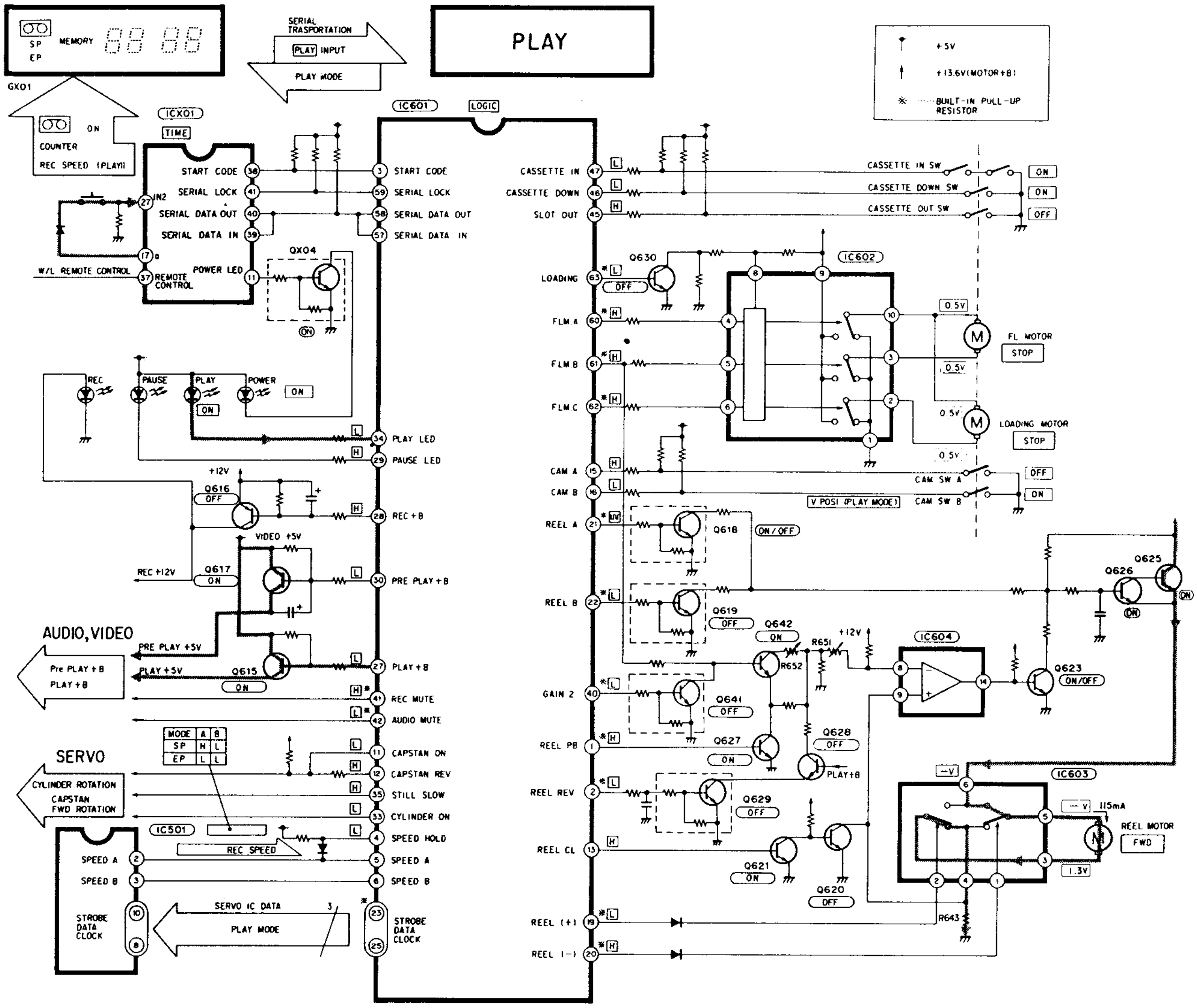

SP
EP
MEMORY
GX01
ON
COUNTER
REC SPEED (PLAY)
SERIAL TRASPORTATION
PLAY INPUT
PLAY MODE
PLAY
ICX01
TIME
IC601
LOGIC
+5V
+13.6V(MOTOR+B)
BUILT-IN PULL-UP RESISTOR
START CODE
SERIAL LOCK
SERIAL DATA OUT
SERIAL DATA IN
W/L REMOTE CONTROL
REMOTE CONTROL
POWER LED
QX04
REC
PAUSE
POWER
PLAY LED
PAUSE LED
+12V
Q616
OFF
REC+B
VIDEO +5V
REC+12V
Q617
PRE PLAY+B
AUDIO,VIDEO
PRE PLAY +5V
Pre PLAY+B
PLAY+B
PLAY+5V
Q615
REC MUTE
AUDIO MUTE
SERVO
MODE
CYLINDER ROTATION
CAPSTAN FWD ROTATION
CAPSTAN ON
CAPSTAN REV
STILL SLOW
CYLINDER ON
SPEED HOLD
SPEED A
SPEED B
IC501
REC SPEED
SERVO IC DATA
PLAY MODE
STROBE
DATA
CLOCK
CASSETTE IN
CASSETTE DOWN
SLOT OUT
CASSETTE IN SW
CASSETTE DOWN SW
CASSETTE OUT SW
LOADING
Q630
IC602
FLM A
FLM B
FLM C
0.5V
FL MOTOR
STOP
LOADING MOTOR
CAM A
CAM B
CAM SW A
CAM SW B
V.POSI (PLAY MODE)
REEL A
Q618
ON/OFF
REEL B
Q619
Q642
R651
R652
IC604
Q625
Q626
Q623
GAIN 2
Q641
Q628
REEL PB
Q627
REEL REV
Q629
REEL CL
Q621
Q620
IC603
115mA
REEL MOTOR
FWD
1.3V
R643
REEL (+)
REEL (−)

Fig. 3-4-3

(1) When the loading operation completes, pin ⑪ of IC601 develops "H" level output and makes the capstan motor rotate in forward direction. At the same time IC601 sends the mode data (playback) to the servo IC (IC501).

(2) IC601 controls IC603 and makes the reel motor rotate in forward direction. The idler touches the T-reel table and transfers rotational force to wind the tape. (㉗ – ㉘)

(3) Under this condition, pin ⑬ of IC601 develops "H" level and Q620 turns off.

Feedback voltage across R643 (by reel current) and a reference voltage at pin ⑧ of IC604 are compared, and if a current higher than the specified flows, Q623 is turned on to lower the base potential of Q626, thus limiting the current to a constant value of approx. 115 mA or driving the tape with a constant torque.

(4) Pin ㉗ of IC601 turns to "L" level and Q615 turns on, connecting the playback +5V to the audio and video circuits to set the playback mode.

(5) The record speed data discriminated by IC501 is sent to GX01 through IC601 and ICX01 and displayed on the FL display tube.

3-4-3 Unloading

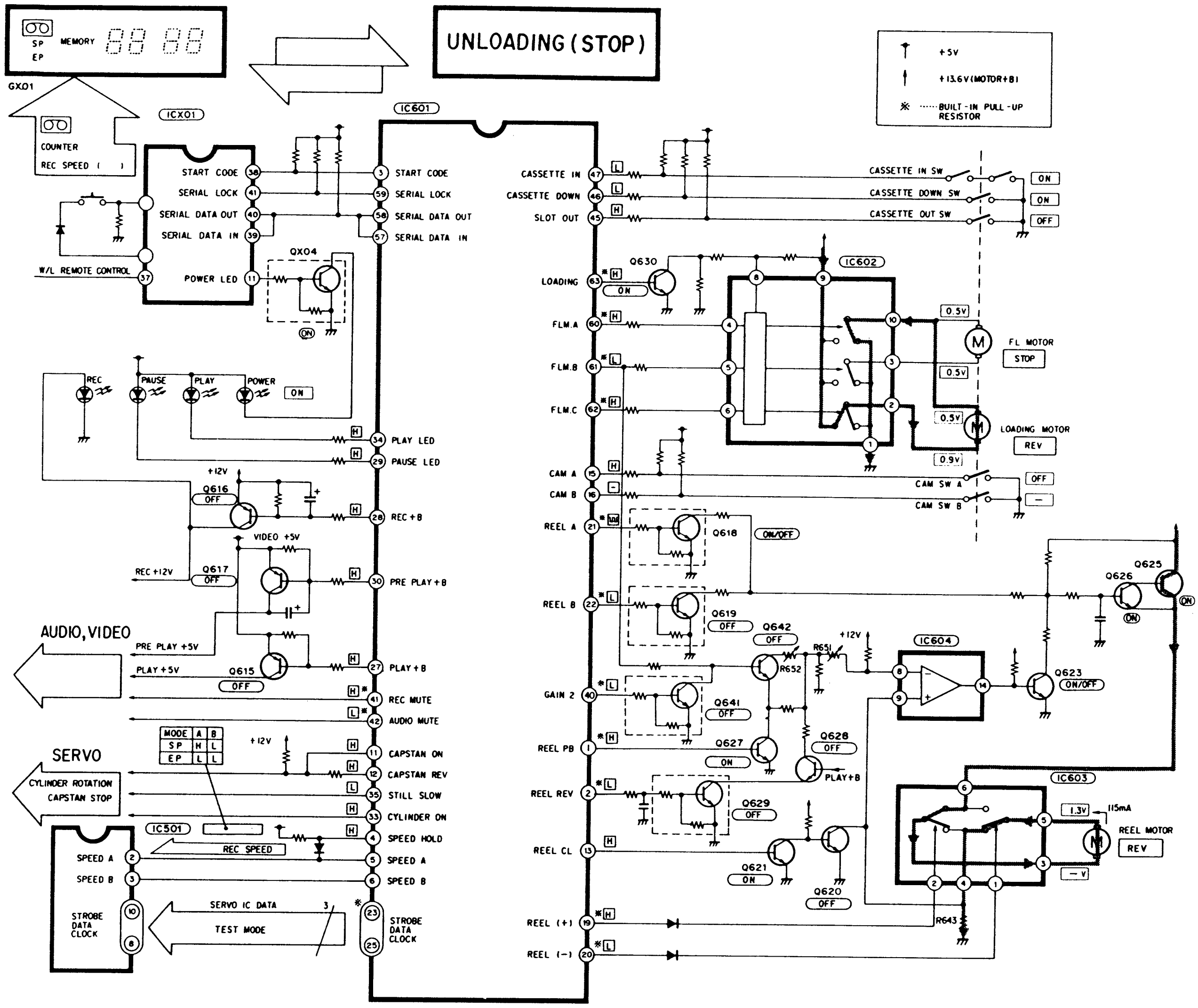

UNLOADING (STOP)
SP
EP
MEMORY
GX01
COUNTER
REC SPEED
ICX01
IC601
+5V
+13.6V(MOTOR+B)
※ ......BUILT-IN PULL-UP RESISTOR
START CODE
SERIAL LOCK
SERIAL DATA OUT
SERIAL DATA IN
POWER LED
W/L REMOTE CONTROL
QX04
ON
REC
PAUSE
PLAY
POWER
PLAY LED
PAUSE LED
Q616
OFF
REC+B
VIDEO +5V
REC+12V
Q617
OFF
PRE PLAY+B
AUDIO,VIDEO
PRE PLAY +5V
PLAY+5V
Q615
OFF
PLAY+B
REC MUTE
AUDIO MUTE
SERVO
CYLINDER ROTATION
CAPSTAN STOP
MODE A B
SP H L
EP L L
+12V
CAPSTAN ON
CAPSTAN REV
STILL SLOW
CYLINDER ON
SPEED HOLD
SPEED A
SPEED B
IC501
REC SPEED
STROBE DATA CLOCK
SERVO IC DATA
TEST MODE
CASSETTE IN
CASSETTE DOWN
SLOT OUT
CASSETTE IN SW
CASSETTE DOWN SW
CASSETTE OUT SW
ON
ON
OFF
LOADING
Q630
ON
IC602
FLM.A
FLM.B
FLM.C
0.5V
FL MOTOR
STOP
LOADING MOTOR
REV
0.9V
CAM A
CAM B
CAM SW A
CAM SW B
OFF
REEL A
Q618
ON/OFF
REEL B
Q619
OFF
Q642
OFF
R651
R652
IC604
Q625
Q626
ON
Q623
ON/OFF
GAIN 2
Q641
OFF
REEL PB
Q627
ON
Q628
OFF
PLAY+B
REEL REV
Q629
OFF
IC603
1.3V
115mA
REEL MOTOR
REV
−V
REEL CL
Q621
ON
Q620
OFF
R643
REEL (+)
REEL (−)

Fig. 3-4-4

(1) When the STOP button is pushed in the playback mode, ICX01 sets IC601 to the stop mode.

(2) The cam gear is in the playback mode (position V).

(3) The cylinder motor rotates and the capstan motor stops after it is driven reversely for applying braking force. At the same time the reel motor also stops.

(4) The loading motor rotates reversely and the cam moves from the position V to the position II.
Under this condition, mechanical parts move in reverse order of the loading operation.

(5) When the cam gear reaches the position IV, pin (63) of IC601 develops "H" level signal and controls the moving speed of the T- and S-sliders.
The reel motor rotates in reverse direction and makes the idler move toward the S-reel table.
As stated in 3-4-2 (3), the reel current flowing through R643 is fed back to pin ⑨ of IC604 to drive the tape with a constant current of approx. 115 mA.

(6) When the cam gear reaches the position II, the cylinder motor, loading motor and the reel motor stop.

3-4-4 Review mode

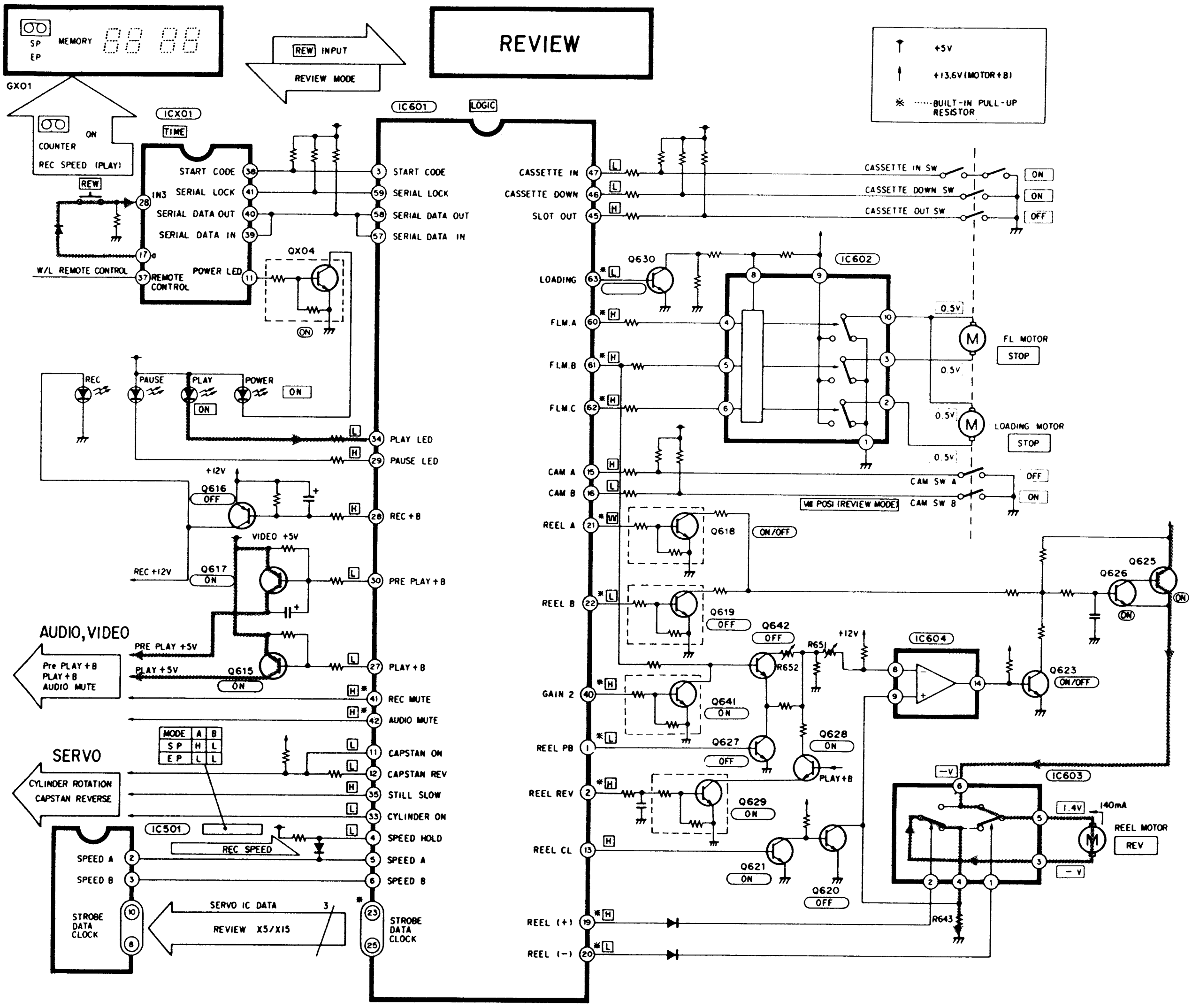

REVIEW
REW INPUT
REVIEW MODE
GX01
SP
EP
MEMORY
ON
COUNTER
REC SPEED (PLAY)
REW
ICX01
TIME
IC601
LOGIC
START CODE
SERIAL LOCK
SERIAL DATA OUT
SERIAL DATA IN
W/L REMOTE CONTROL
REMOTE CONTROL
POWER LED
QX04
REC
PAUSE
PLAY
POWER
PLAY LED
PAUSE LED
+12V
Q616
OFF
REC+B
VIDEO +5V
REC+12V
Q617
PRE PLAY+B
AUDIO,VIDEO
PRE PLAY +5V
PLAY+5V
Q615
PLAY+B
Pre PLAY+B
PLAY+B
AUDIO MUTE
REC MUTE
MODE A B
SP H L
EP L L
SERVO
CYLINDER ROTATION
CAPSTAN REVERSE
CAPSTAN ON
CAPSTAN REV
STILL SLOW
CYLINDER ON
SPEED HOLD
SPEED A
SPEED B
IC501
REC SPEED
STROBE
DATA
CLOCK
SERVO IC DATA
REVIEW X5/X15
CASSETTE IN
CASSETTE DOWN
SLOT OUT
CASSETTE IN SW
CASSETTE DOWN SW
CASSETTE OUT SW
+5V
+13.6V(MOTOR+B)
※ ······BUILT-IN PULL-UP RESISTOR
LOADING
Q630
IC602
FLM A
FLM.B
FLM.C
FL MOTOR
STOP
LOADING MOTOR
0.5V
CAM A
CAM B
CAM SW A
CAM SW B
VII POSI (REVIEW MODE)
REEL A
Q618
ON/OFF
REEL B
Q619
Q642
R651
R652
IC604
Q625
Q626
Q623
GAIN 2
Q641
REEL PB
Q627
Q628
PLAY+B
REEL REV
Q629
IC603
-V
1.4V
140mA
REEL MOTOR
REV
REEL CL
Q621
Q620
R643
REEL (+)
REEL (-)

Fig. 3-4-5

(1) When the REW button is pushed in the playback mode, IC601 is set to the review mode.

(2) Pin ㊷ of IC601 develops "H" level and mutes audio signals.

In this case, the cylinder motor rotates but the capstan motor stops temporarily after it is driven in force to the T-reel table, thus winding the tape.

(3) The reel motor is driven at a constant voltage in forward direction and the idler transfers rotational energy to the T-reel table, thus winding the tape.

(4) The loading motor rotates in forward direction (direction ①) and the cam moves from the position V to the position VII. In this case, the cam gear rotates forwardly (① – ⑥) and the pinch roller moves away from the capstan. (⑥ – ⑦)

The logic slider also moves, T- and S-soft brakes are applied, and the tension lever moves away from No. 1 guide. (⑥ – ⑩)

Furthermore, the brake slider moves, and T- and S-main brakes operate. (⑪ – ⑱)

(5) Then the cam gear reaches the position VII, the loading motor stops and the reel motor rotates reversely.

In this case, the idler moves toward the S-reel table to wind the the tape so that the tape does not slip off the cylinder.

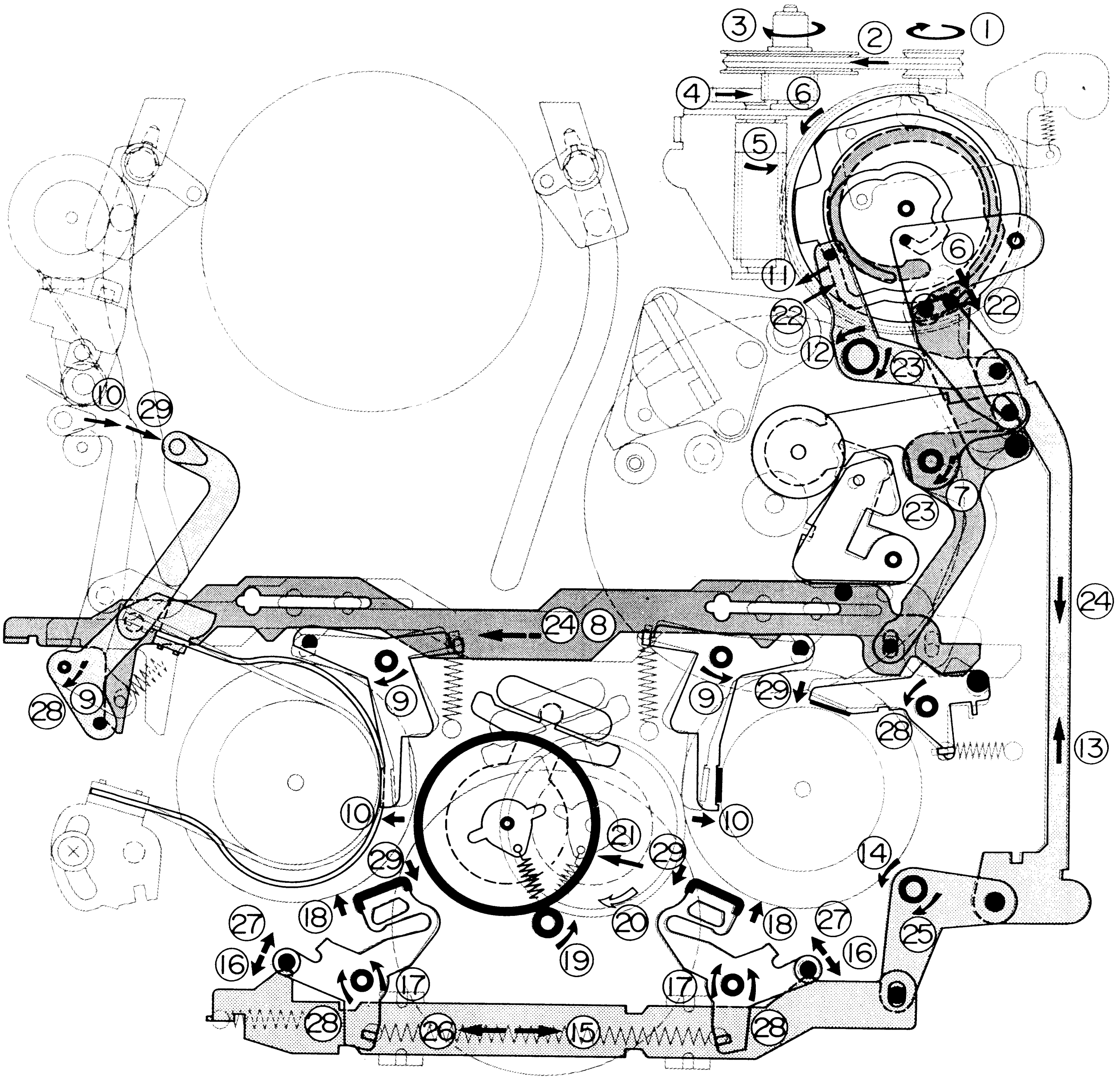


Fig. 3-4-6

(6) Next, the loading motor rotates in forward direction (direction ①) and the cam moves from position VII to VIII.

In this case the cam gear rotates (① – ⑥), the brake slider moves and the T- and S-main brakes are released. (㉒ – ㉙)

The pinch lock lever moves and the pinch roller presses the capstan properly. (㉒ – ㉓)

The logic slider also moves, reverse braking force is applied, and the tension lever moves away from No. 1 guide. (㉒ – ㉙)

(7) When the cam gear reaches the review mode (position VIII), the loading motor stops.

(8) The capstan motor rotates reversely and sets the capstan speed (tape speed) 5 times.

(9) The reel motor also rotates reversely and the idler transfers the rotational force to the S-reel table and the reel winds the tape.

In this case, as stated in 3-4-2 (3) drive current is limited to approx. 140 mA so that the tape is driven with a constant torque.

(10) When the REW button is being pushed in the EP mode, IC501 sets the capstan speed to 15 times the normal speed.

3-4-5 Still mode

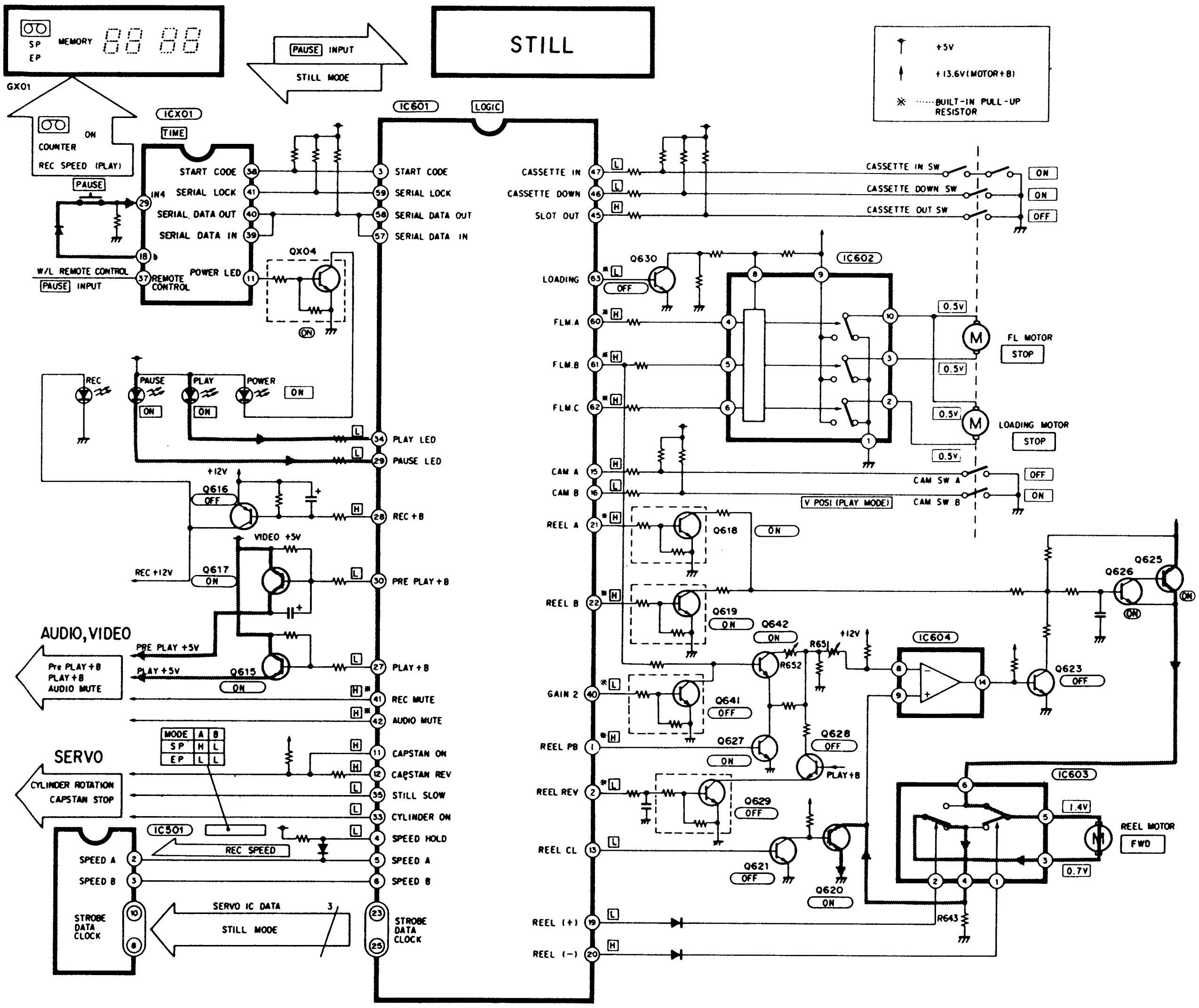

STILL
PAUSE INPUT
STILL MODE
GX01
SP
EP
MEMORY
COUNTER
REC SPEED (PLAY)
PAUSE
ICX01
TIME
START CODE
SERIAL LOCK
SERIAL DATA OUT
SERIAL DATA IN
IN4
W/L REMOTE CONTROL
PAUSE INPUT
REMOTE CONTROL
POWER LED
QX04
ON
IC601
LOGIC
CASSETTE IN
CASSETTE DOWN
SLOT OUT
LOADING
FLM.A
FLM.B
FLM.C
CAM A
CAM B
REEL A
REEL B
GAIN 2
REEL PB
REEL REV
REEL CL
REEL (+)
REEL (−)
PLAY LED
PAUSE LED
REC+B
PRE PLAY+B
PLAY+B
REC MUTE
AUDIO MUTE
CAPSTAN ON
CAPSTAN REV
STILL SLOW
CYLINDER ON
SPEED HOLD
SPEED A
SPEED B
STROBE DATA CLOCK
REC
PAUSE
PLAY
POWER
+12V
Q616
OFF
VIDEO +5V
REC+12V
Q617
AUDIO, VIDEO
PRE PLAY +5V
PLAY +5V
Pre PLAY+B
PLAY+B
AUDIO MUTE
Q615
SERVO
CYLINDER ROTATION
CAPSTAN STOP
MODE A B
SP H L
EP L L
IC501
REC SPEED
SERVO IC DATA
STILL MODE
+5V
+13.6V (MOTOR+B)
BUILT-IN PULL-UP RESISTOR
CASSETTE IN SW
CASSETTE DOWN SW
CASSETTE OUT SW
OFF
Q630
IC602
0.5V
FL MOTOR
STOP
LOADING MOTOR
CAM SW A
CAM SW B
V POSI (PLAY MODE)
Q618
Q619
Q642
R651
R652
IC604
Q625
Q626
Q623
Q641
Q627
Q628
Q629
Q621
Q620
IC603
1.4V
0.7V
REEL MOTOR
FWD
R643

Fig. 3-4-7

(1) When the PAUSE button is pushed during the playback mode, IC601 is set to the still mode.

(2) The cam gear is in the playback mode (position V) and the cylinder motor is rotating.
Under this condition each pin of IC601 develops output voltage as shown in Fig. 3-4-7.

(3) Pin ㊷ of IC601 develops "H" level and mutes audio signals.

(4) A mode data (still) is sent to IC501.

(5) The capstan motor is driven intermittently (Refer to Fig. 3-4-9) and then stopped.

(6) The reel motor is driven at a constant voltage and the idler transfers rotational force to the T-reel table, thus winding the tape.
Under this condition a voltage of approx. 0.7V is applied to the motor terminals to prevent tape slack.

(7) IC601 maintains the speed data presented just before the still operation was performed and sends the data to IC501.

3-4-6 Slow mode

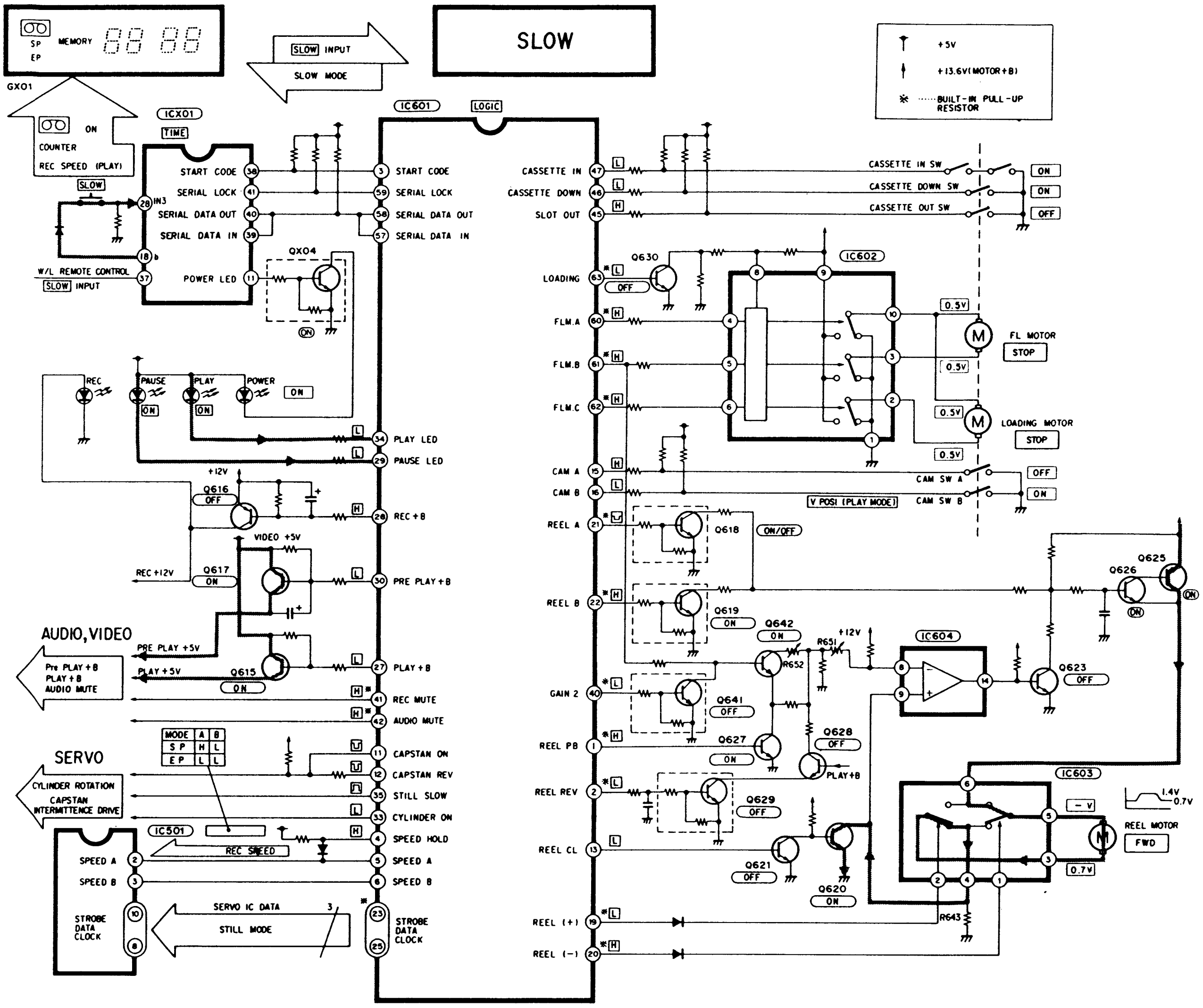

SLOW
SLOW INPUT
SLOW MODE
GX01
MEMORY
SP
EP
ON
COUNTER
REC SPEED (PLAY)
ICX01
TIME
IC601
LOGIC
START CODE
SERIAL LOCK
SERIAL DATA OUT
SERIAL DATA IN
POWER LED
W/L REMOTE CONTROL
SLOW INPUT
QX04
REC
PAUSE
PLAY
POWER
PLAY LED
PAUSE LED
REC+B
PRE PLAY+B
PLAY+B
REC MUTE
AUDIO MUTE
Q616
Q617
Q615
VIDEO +5V
REC+12V
+12V
AUDIO, VIDEO
Pre PLAY+B
PLAY+B
AUDIO MUTE
SERVO
CYLINDER ROTATION
CAPSTAN
INTERMITTENCE DRIVE
IC501
REC SPEED
CAPSTAN ON
CAPSTAN REV
STILL SLOW
CYLINDER ON
SPEED HOLD
SPEED A
SPEED B
STROBE
DATA
CLOCK
SERVO IC DATA
STILL MODE
MODE A B
SP H L
EP L L
+5V
+13.6V(MOTOR+B)
BUILT-IN PULL-UP RESISTOR
CASSETTE IN
CASSETTE DOWN
SLOT OUT
CASSETTE IN SW
CASSETTE DOWN SW
CASSETTE OUT SW
LOADING
FLM.A
FLM.B
FLM.C
Q630
IC602
FL MOTOR
STOP
LOADING MOTOR
0.5V
CAM A
CAM B
CAM SW A
CAM SW B
V POSI (PLAY MODE)
REEL A
REEL B
Q618
Q619
Q642
Q641
Q627
Q628
Q629
Q621
Q620
Q623
Q625
Q626
IC604
IC603
R651
R652
R643
GAIN 2
REEL PB
REEL REV
REEL CL
REEL (+)
REEL (−)
REEL MOTOR
FWD
1.4V
0.7V
0.7V
−V
ON/OFF
OFF
ON

Fig. 3-4-8

(1) When the SLOW button is pushed during the still operation, the capstan motor and the reel motor rotate and feed a length of tape equivalent to one frame.
When the SLOW button is being pushed, the capstan motor and the reel motor are intermittently driven so that the tape speed is slow down to approx. 1/10. (Refer to Fig. 3-4-9)

Table 3-4-1

Mode		T_1 (ms)	T_2 (ms)	T_3 (ms)	T_4 (ms)
WA4	SP	5.6	18.0	35.0	4.5
	EP	14.4	10.0	20.0	

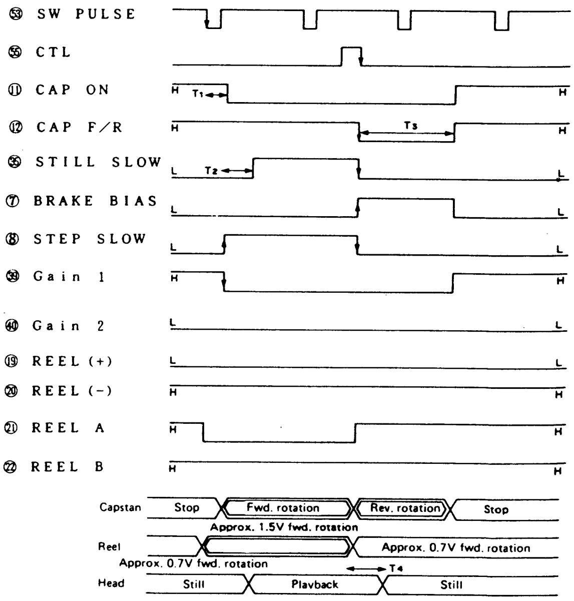


Fig. 3-4-9 Basic timing chart for still, frame feeding and slow operation

3-4-7 Cue mode

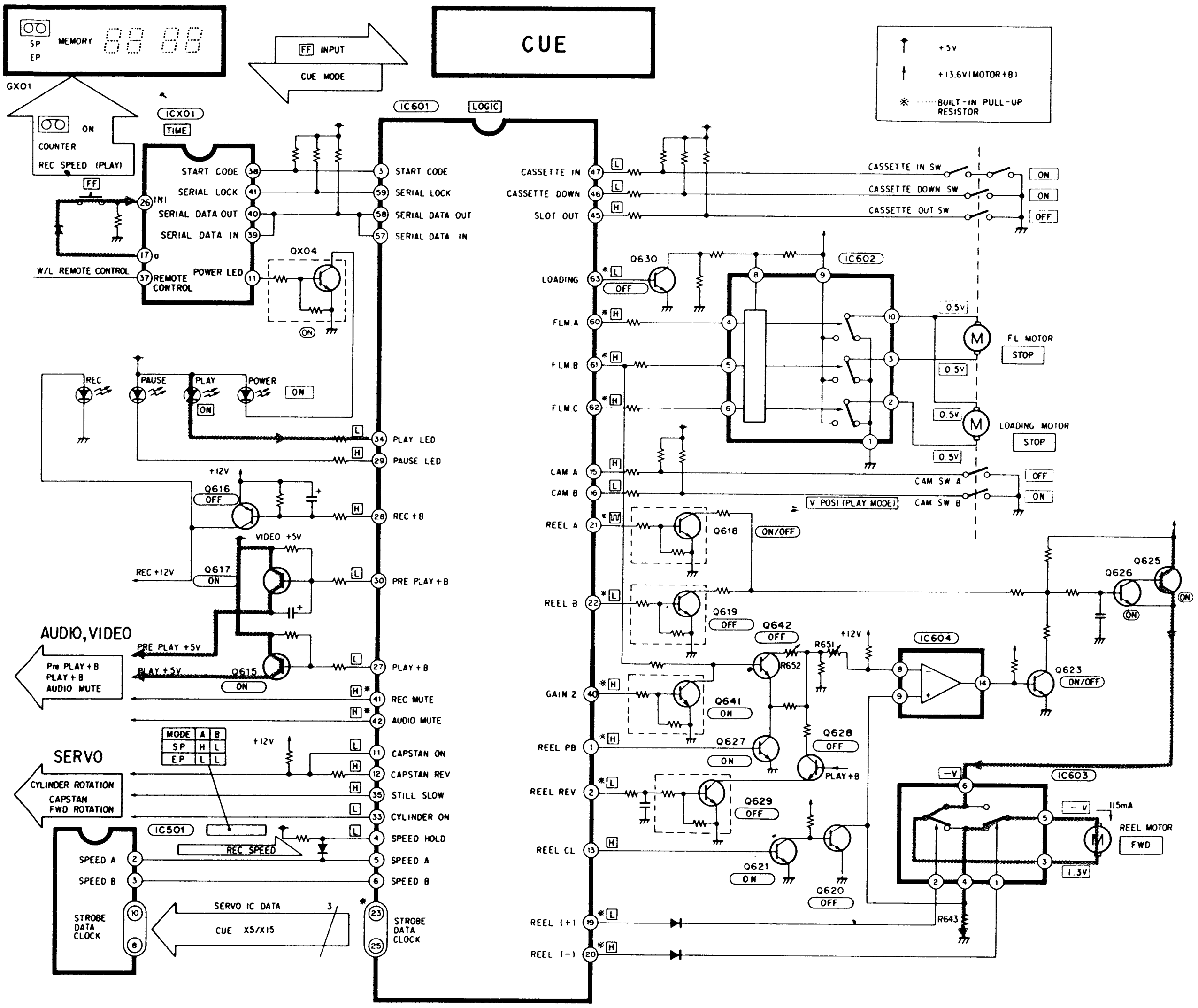

CUE
FF INPUT
CUE MODE
GX01
MEMORY
SP
EP
ON
COUNTER
REC SPEED (PLAY)
FF
ICX01
TIME
START CODE
SERIAL LOCK
SERIAL DATA OUT
SERIAL DATA IN
INI
W/L REMOTE CONTROL
REMOTE CONTROL
POWER LED
QX04
IC601
LOGIC
+5V
+13.6V(MOTOR+B)
BUILT-IN PULL-UP RESISTOR
CASSETTE IN
CASSETTE DOWN
SLOT OUT
CASSETTE IN SW
CASSETTE DOWN SW
CASSETTE OUT SW
OFF
LOADING
FLM A
FLM B
FLM C
Q630
IC602
FL MOTOR
STOP
LOADING MOTOR
CAM A
CAM B
CAM SW A
CAM SW B
V POSI (PLAY MODE)
REEL A
REEL B
Q618
ON/OFF
Q619
Q642
Q625
Q626
IC604
Q623
GAIN 2
Q641
REEL PB
Q627
Q628
PLAY+B
REEL REV
Q629
IC603
115mA
REEL MOTOR
FWD
REEL CL
Q621
Q620
REEL (+)
REEL (−)
R643
R651
R652
REC
PAUSE
PLAY
POWER
PLAY LED
PAUSE LED
+12V
Q616
REC+B
VIDEO +5V
REC+12V
Q617
PRE PLAY+B
AUDIO,VIDEO
PRE PLAY +5V
PLAY +5V
Q615
PRE PLAY+B
PLAY+B
AUDIO MUTE
REC MUTE
SERVO
MODE A B
SP H L
EP L L
CYLINDER ROTATION
CAPSTAN FWD ROTATION
CAPSTAN ON
CAPSTAN REV
STILL SLOW
CYLINDER ON
SPEED HOLD
SPEED A
SPEED B
IC501
REC SPEED
SERVO IC DATA
CUE X5/X15
STROBE
DATA
CLOCK

Fig. 3-4-10

(1) When the FF button is pushed during the playback mode, IC601 is set to the cue (FF playback) mode. Under this condition, the cam gear is set to the playback mode (position V).

(2) The cylinder motor rotates and the capstan motor rotates in forward direction.

(3) Pin outputs of IC601 in the cue mode are shown in Fig. 3-4-10.

(4) Pin ㊷ of IC601 develops "H" level and mutes audio signals.

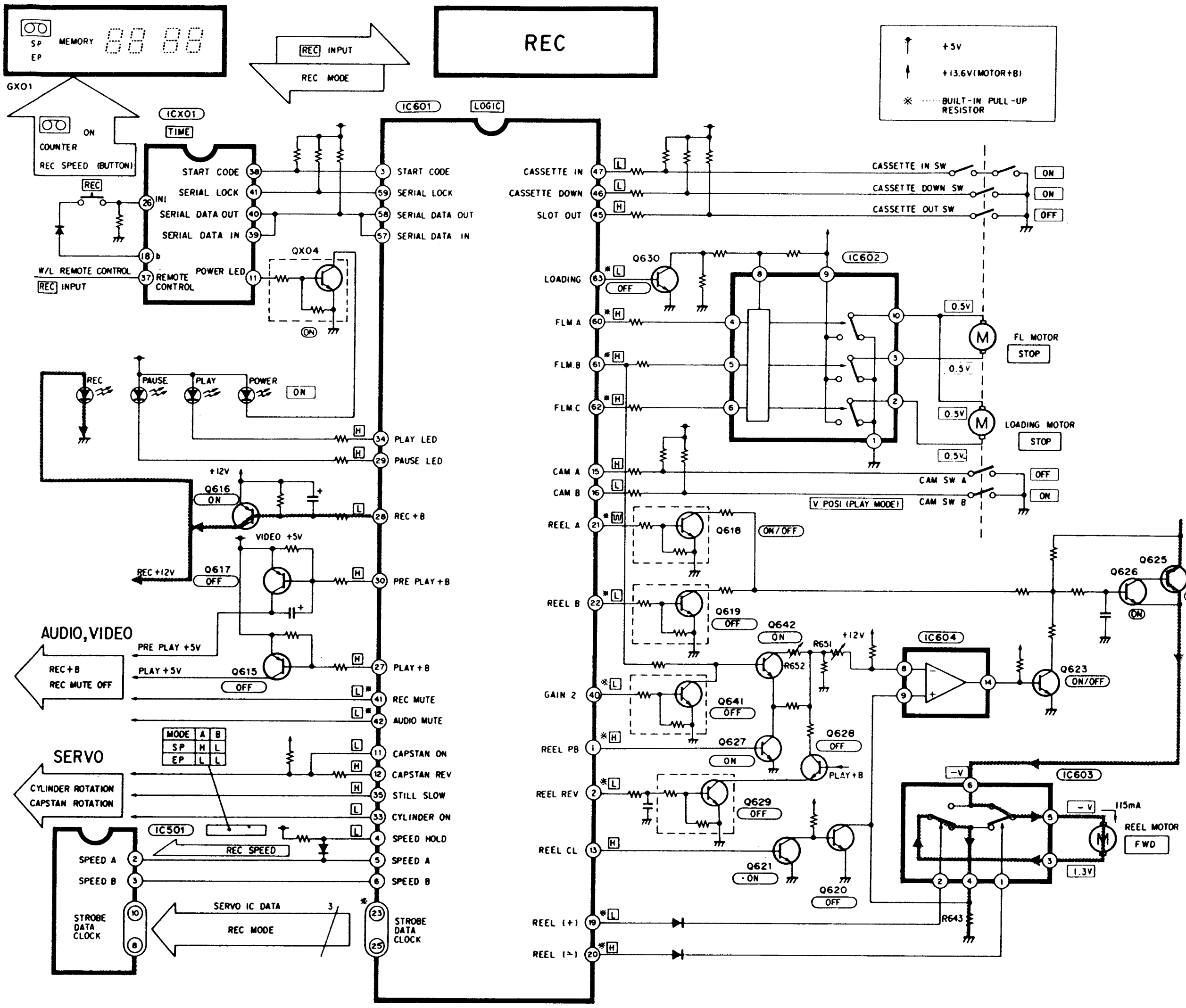
(5) A mode data (cue 5 times speed in this case) is sent to IC501, and the capstan speed is set to 5 times the normal speed.

(6) The reel motor rotates in forward direction and the idler transfers rotational force to the T-reel table to wind the tape. In this case, the reel is driven at a constant current as mentioned in 3-4-2 (3) so that constant tape tension is assured.

(7) When the FF button is being pushed in the EP mode, the capstan speed is set to 15 times the normal speed.

3-5 Record System Mode

3-5-1 Record mode (from stop mode)



SP
EP
MEMORY
GX01
REC INPUT
REC MODE
REC
ICX01
TIME
IC601
LOGIC
+5V
+13.6V(MOTOR+B)
※ BUILT-IN PULL-UP RESISTOR
ON
COUNTER
REC SPEED (BUTTON)
START CODE
SERIAL LOCK
SERIAL DATA OUT
SERIAL DATA IN
INI
W/L REMOTE CONTROL
REC INPUT
REMOTE CONTROL
POWER LED
QX04
CASSETTE IN
CASSETTE DOWN
SLOT OUT
CASSETTE IN SW
CASSETTE DOWN SW
CASSETTE OUT SW
ON
ON
OFF
LOADING
Q630
OFF
IC602
FLM A
FLM B
FLM C
FL MOTOR
STOP
0.5V
LOADING MOTOR
STOP
PAUSE
PLAY
POWER
PLAY LED
PAUSE LED
CAM A
CAM B
CAM SW A
CAM SW B
V POSI (PLAY MODE)
+12V
Q616
ON
REC+B
REEL A
Q618
ON/OFF
VIDEO +5V
REC+12V
Q617
OFF
PRE PLAY+B
REEL B
Q619
OFF
Q642
ON
Q625
Q626
ON
AUDIO,VIDEO
PRE PLAY +5V
PLAY +5V
Q615
OFF
REC+B
REC MUTE OFF
PLAY+B
R651
R652
IC604
Q623
ON/OFF
GAIN 2
Q641
OFF
REC MUTE
AUDIO MUTE
MODE A B
SP H L
EP L L
SERVO
CYLINDER ROTATION
CAPSTAN ROTATION
CAPSTAN ON
CAPSTAN REV
STILL SLOW
CYLINDER ON
SPEED HOLD
SPEED A
SPEED B
REEL PB
Q627
ON
Q628
OFF
PLAY+B
IC603
REEL REV
Q629
OFF
-V
115mA
REEL MOTOR
FWD
IC501
REC SPEED
REEL CL
Q621
ON
1.3V
Q620
OFF
SERVO IC DATA
REC MODE
STROBE DATA CLOCK
REEL (+)
REEL (-)
R643

Fig. 3-5-1

(1) When the REC button is pushed in the stop mode, ICX01 transfers the record input signal serially to IC601 and sets the record mode.

(2) Pin ㉘ of IC601 develops "L" level and Q616 turns on, thus supplying the REC+12V to the audio, video, and the servo circuits.
The REC LED is also turned on.

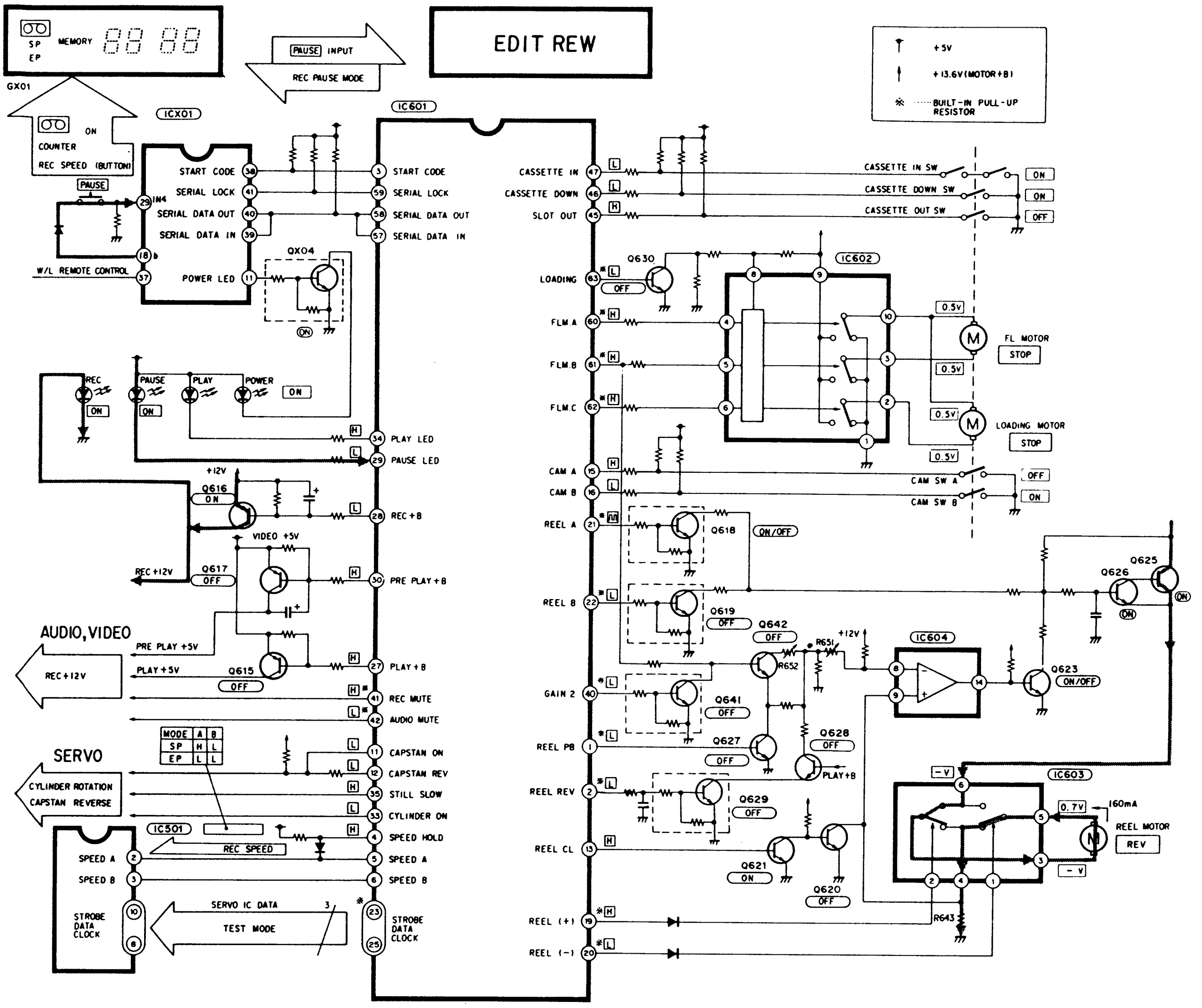
(3) The loading mode is set as mentioned in 3-4-1 (1) – (7).

(4) Next, operations which are the same as those mentioned in the playback mode 3-4-2 (1) – (3) are performed and the tape is driven.

(5) Pin ㊶ of IC601 goes "L" level and the record muting for the audio and video circuits are released, and the recording will be made.

(6) A record speed data is sent to IC501 through ICX01 and IC601, thus designating the speed switching.

3-5-2 Rewinding for synchronous editing



SP
EP
MEMORY
GX01
ON
COUNTER
REC SPEED (BUTTON)
PAUSE
W/L REMOTE CONTROL
EDIT REW
PAUSE INPUT
REC PAUSE MODE
ICX01
IC601
START CODE
SERIAL LOCK
SERIAL DATA OUT
SERIAL DATA IN
POWER LED
QX04
ON
REC
PAUSE
PLAY
POWER
ON
PLAY LED
PAUSE LED
+12V
Q616
ON
REC+8
VIDEO +5V
REC+12V
Q617
OFF
PRE PLAY+8
AUDIO, VIDEO
PRE PLAY +5V
PLAY+5V
Q615
OFF
PLAY+8
REC MUTE
AUDIO MUTE
SERVO
MODE A B
SP H L
EP L L
CYLINDER ROTATION
CAPSTAN REVERSE
CAPSTAN ON
CAPSTAN REV
STILL SLOW
CYLINDER ON
SPEED HOLD
SPEED A
SPEED B
IC501
REC SPEED
STROBE
DATA
CLOCK
SERVO IC DATA
TEST MODE
+5V
+13.6V (MOTOR+B)
※ BUILT-IN PULL-UP RESISTOR
CASSETTE IN
CASSETTE DOWN
SLOT OUT
CASSETTE IN SW
CASSETTE DOWN SW
CASSETTE OUT SW
ON
ON
OFF
LOADING
Q630
OFF
IC602
FLM A
FLM B
FLM C
0.5V
FL MOTOR
STOP
LOADING MOTOR
STOP
CAM A
CAM B
CAM SW A
CAM SW B
OFF
ON
REEL A
Q618
ON/OFF
REEL B
Q619
OFF
Q642
OFF
R651
R652
IC604
Q625
Q626
ON
ON
Q623
ON/OFF
GAIN 2
Q641
OFF
REEL PB
Q627
OFF
Q628
OFF
PLAY+8
REEL REV
Q629
OFF
REEL CL
Q621
ON
Q620
OFF
IC603
-V
0.7V
160mA
REEL MOTOR
REV
REEL (+)
REEL (-)
R643

Fig. 3-5-2

(1) When the PAUSE or STOP button is pushed during recording, IC 601 is set to a record pause mode or the stop mode.
In this case, the cam gear is set to the playback (position V) mode.

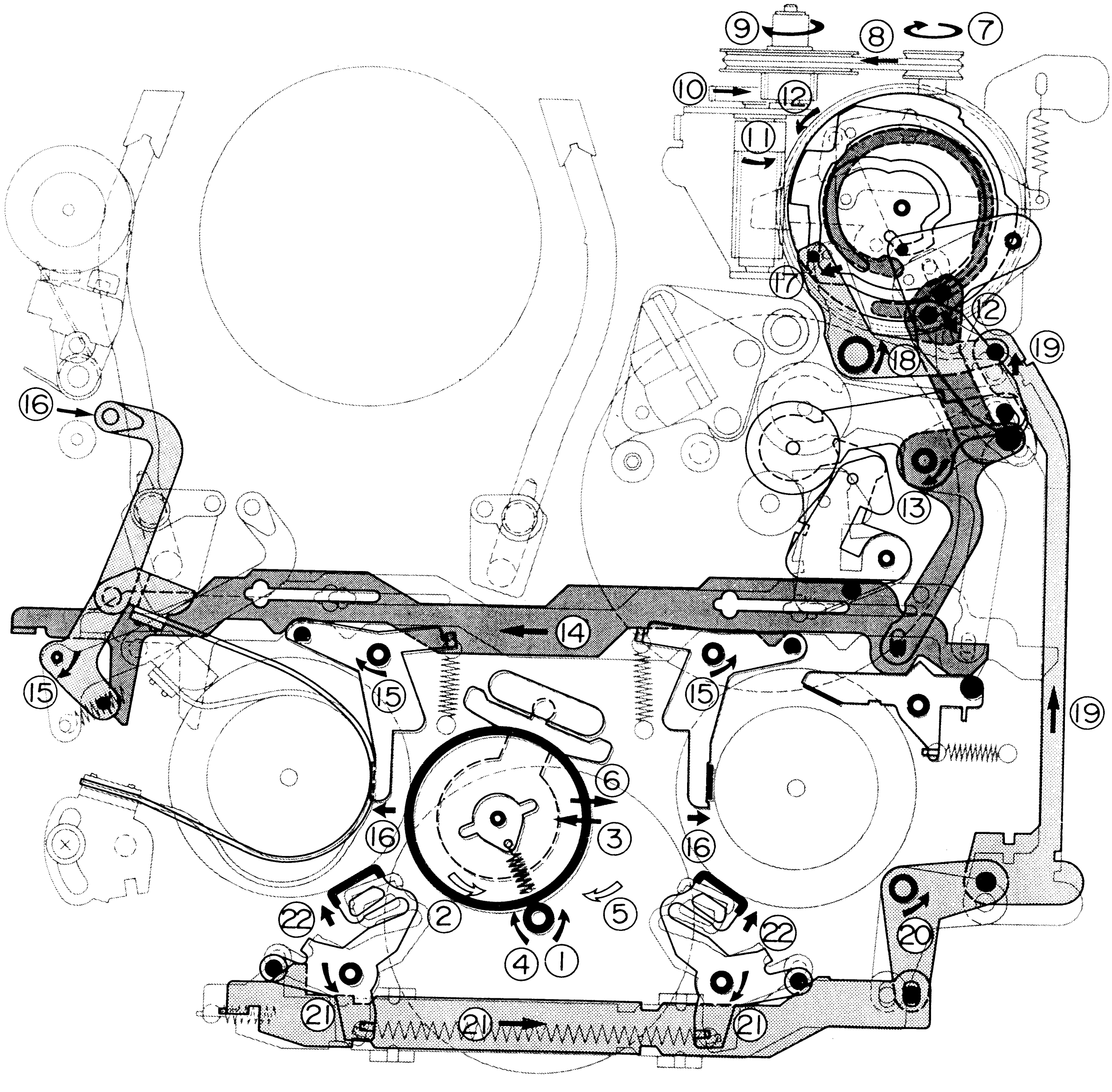
(2) The cylinder motor rotates and the capstan and the reel motors also rotate in forward direction.

(3) Each pin of IC601 develops output as shown in Fig. 3-5-2 and the record LED lights up.
Pin ㊶ of IC601 develops "H" level output and mutes audio and video signals.

(4) The reel motor is rotated reversely by IC601 and IC603, and the S-reel table is driven with a constant current of approx. 160mA so that the tape is fed at a constant torque. (① – ③)
The capstan motor rotates in reverse direction and winds the tape for a specified length, and then the motor stops.

(5) Next, the reel motor rotates in forward direction and drives the T-reel table with a constant current. (④ – ⑥) In this case, the capstan motor also rotates forwardly and winds the tape for a specified length and then the motor stops.

(6) The reel motor stops.


⑨
⑧
⑦
⑩
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⑪
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⑭
⑮
⑮
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⑥
⑯
③
⑯
⑤
㉒
②
㉒
④
①
⑳
㉑
㉑
㉑
㉑

Fig. 3-5-3

3-5-3 Stop mode (from record to stop)

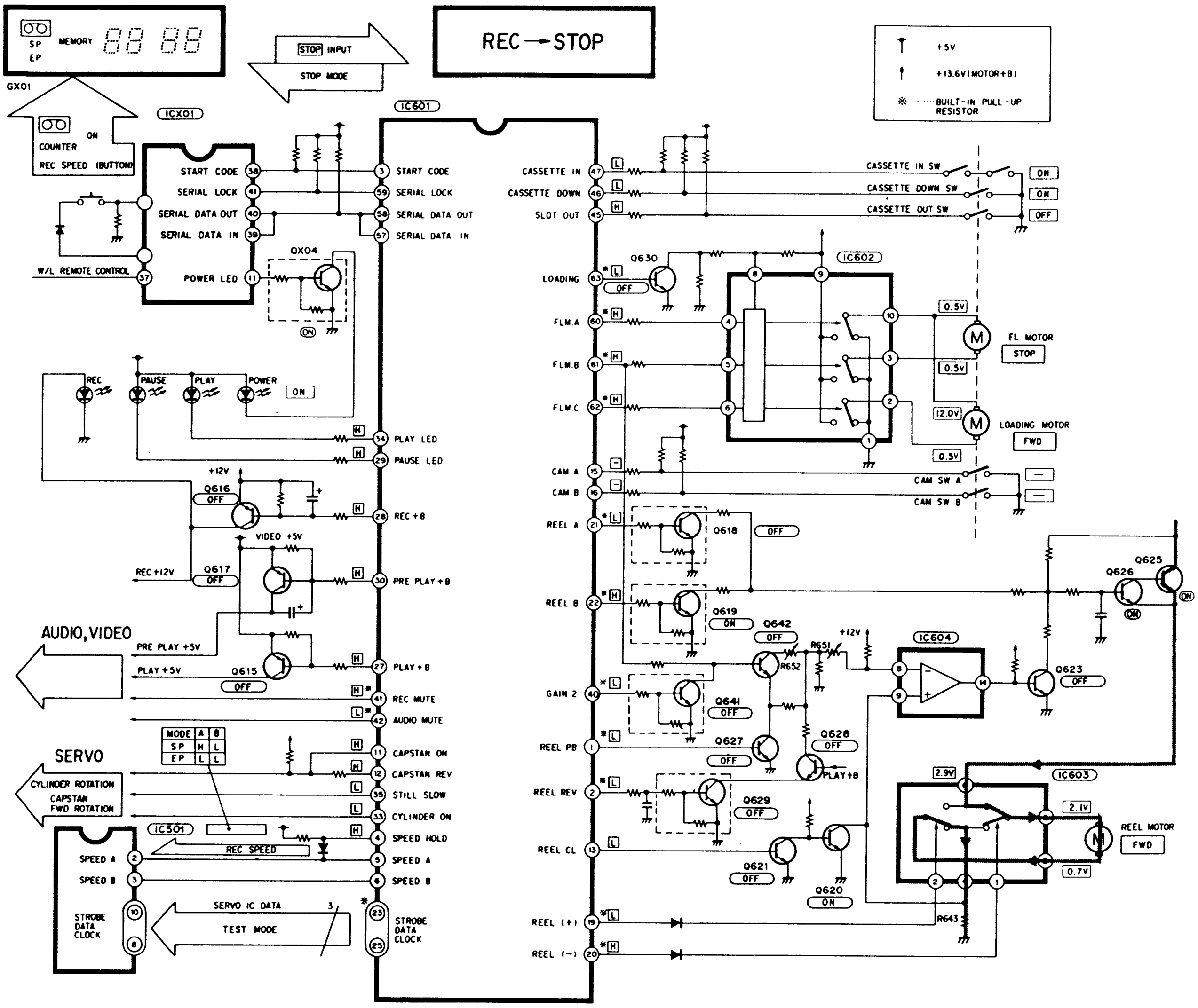

REC → STOP
STOP INPUT
STOP MODE
SP
EP
MEMORY
GX01
ON
COUNTER
REC SPEED (BUTTON)
W/L REMOTE CONTROL
ICX01
START CODE
SERIAL LOCK
SERIAL DATA OUT
SERIAL DATA IN
POWER LED
QX04
IC601
CASSETTE IN
CASSETTE DOWN
SLOT OUT
LOADING
FLM.A
FLM.B
FLM.C
CAM A
CAM B
REEL A
REEL B
GAIN 2
REEL PB
REEL REV
REEL CL
REEL (+)
REEL (−)
+5V
+13.6V(MOTOR+B)
※ BUILT-IN PULL-UP RESISTOR
CASSETTE IN SW
CASSETTE DOWN SW
CASSETTE OUT SW
OFF
Q630
IC602
FL MOTOR
STOP
LOADING MOTOR
FWD
0.5V
12.0V
CAM SW A
CAM SW B
Q618
Q619
Q642
Q641
Q627
Q628
Q629
Q621
Q620
Q623
Q625
Q626
IC604
IC603
R651
R652
R643
+12V
PLAY+B
2.9V
2.1V
0.7V
REEL MOTOR
REC
PAUSE
PLAY
POWER
PLAY LED
PAUSE LED
REC+B
Q616
Q617
Q615
VIDEO +5V
REC+12V
PRE PLAY+B
PRE PLAY +5V
PLAY +5V
AUDIO,VIDEO
REC MUTE
AUDIO MUTE
SERVO
CYLINDER ROTATION
CAPSTAN FWD ROTATION
MODE A B
SP H L
EP L L
CAPSTAN ON
CAPSTAN REV
STILL SLOW
CYLINDER ON
SPEED HOLD
SPEED A
SPEED B
IC501
REC SPEED
SERVO IC DATA
TEST MODE
STROBE DATA CLOCK

Fig. 3-5-4

(1) When the STOP button is pushed during recording, the unit enters the stop mode after completion of temporary rewind operation for synchronous editing. The cam gear is in the playback mode (position V).

(2) The cylinder motor rotates and the capstan motor stops.

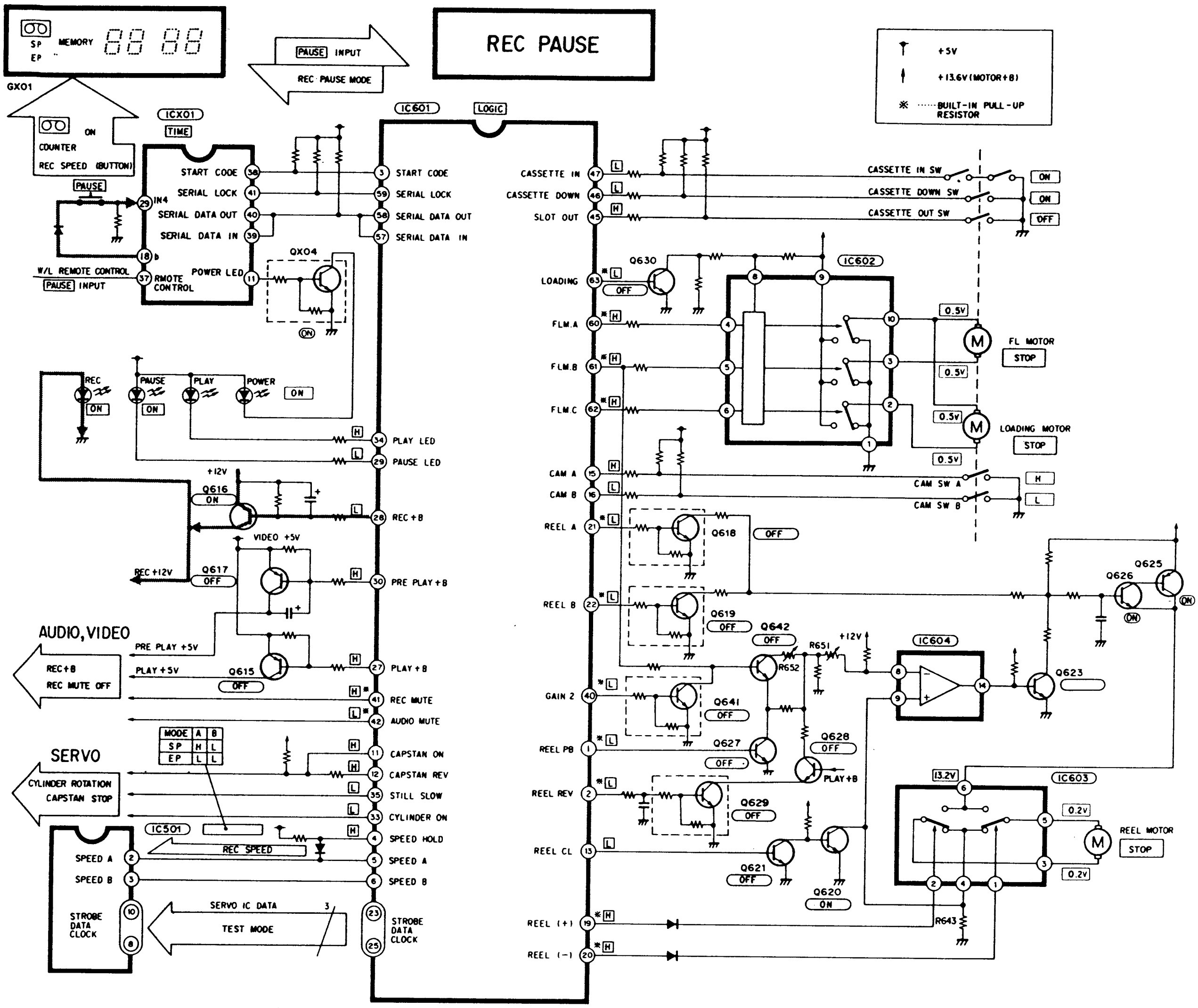
(3) The reel motor is rotated in forward direction by IC601 and IC603.
Pin ㉒ of IC601 develops "H" level and Q619 turns on, setting the motor terminal voltage to approx. 1.5V and winding the tape without causing tape slack.

(4) The loading motor is rotated forwardly (direction shown by Fig. 3-5-3 ⑦) by IC601 and IC602, and the cam moves from the position V to the position VII. At the same time, the cam gear rotates (⑦ – ⑫) and the mechanical parts operate as mentioned in the review mode, 3-4-4 (4).

(5) When the cam gear reaches the position VII, the loading motor and the reel motor stop.

(6) When the STOP button is pushed again, unloading operation starts and the cam moves to the position II. (Refer to the unloading operation.)

3-5-4 Record pause (PAUSE)



REC PAUSE
PAUSE INPUT
REC PAUSE MODE
GX01
ICX01
TIME
IC601
LOGIC
IC602
IC603
IC604
IC501
START CODE
SERIAL LOCK
SERIAL DATA OUT
SERIAL DATA IN
POWER LED
W/L REMOTE CONTROL
CASSETTE IN
CASSETTE DOWN
SLOT OUT
LOADING
FLM.A
FLM.B
FLM.C
CAM A
CAM B
REEL A
REEL B
GAIN 2
REEL PB
REEL REV
REEL CL
REEL (+)
REEL (-)
PLAY LED
PAUSE LED
REC+B
PRE PLAY+B
PLAY+B
REC MUTE
AUDIO MUTE
CAPSTAN ON
CAPSTAN REV
STILL SLOW
CYLINDER ON
SPEED HOLD
SPEED A
SPEED B
STROBE DATA CLOCK
AUDIO,VIDEO
SERVO
CYLINDER ROTATION CAPSTAN STOP
REC SPEED
SERVO IC DATA
TEST MODE
FL MOTOR STOP
LOADING MOTOR STOP
REEL MOTOR STOP
CASSETTE IN SW ON
CASSETTE DOWN SW ON
CASSETTE OUT SW OFF
+5V
+13.6V (MOTOR+B)
※ BUILT-IN PULL-UP RESISTOR
Q616 ON
Q617 OFF
Q615 OFF
Q618 OFF
Q619 OFF
Q630 OFF
Q642 OFF
Q641 OFF
Q627 OFF
Q628 OFF
Q629 OFF
Q621 OFF
Q620 ON
Q623
Q625
Q626
QX04
MODE A B
SP H L
EP L L

Fig. 3-5-5

(1) When the PAUSE button is pushed during a recording, the unit enters the record pause mode after completion of temporary rewinding operation for synchronous editing.
In this case, the cam gear is in the playback mode (position V).

(2) The cylinder motor rotates, and the capstan motor and the reel motor stop.

(3) Each pin of IC601 develops the output as shown above and the pause LED lights up.
Pin ㉘ of IC601 develops "L" level output and Q616 turns on, thus connecting the REC + 12V to the audio and video, and the servo circuits. The record LED lights up.

(4) Pin ㊶ of IC601 develops "H" level output and mutes audio and video signals.

(5) A speed data for recording is sent to IC501 through ICX01 and IC601, and is used for speed switching.

4. ELECTRIC CIRCUITS

4-1 Power Supply Circuit

4-1-1 AC Voltage conversion circuit

1) The AC voltage conversion circuit is comprised of a 105V fuse (F801), 210V fuse (F803) and AC voltage switch (S801).
   winding with several taps for voltage selection.
2) With S801 placed in the range 1 position, AC input of 105V (100 – 110V) is selected. In the same way, the range 2 selects 120V (115 – 127V), the range 3 210V (200 – 220V) and the range 4 240V (230 – 250V).

4-1-2 Rectification circuits

1) The power supply circuit consists of three system rectifier circuits, voltage regulator circuits following the rectifier circuits, and a heater power supply circuit AC 3.6V) for the FL display tube. Fig. 4-1-1 shows the power system diagram.

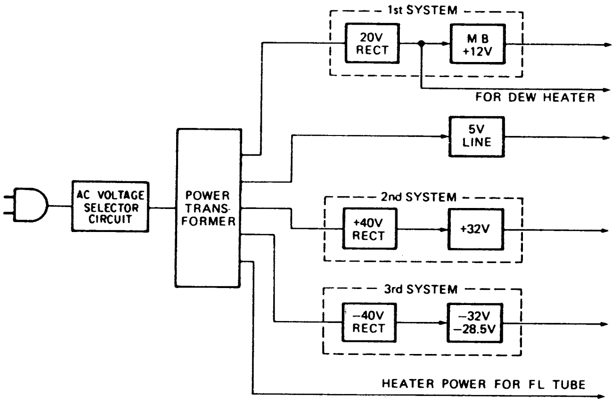


Fig. 4-1-1 Power supply circuit block diagram

2) The first rectifier system contains a rectifier circuit for the main power supply of + 12V and a power supply for the dew heater. The rectifier circuit consists of D801 through D804 and C804, and develops approx. 20V DC.
   A center tap voltage of the secondary winding of the power transformer is also rectified to 10V DC for input voltage of 5V voltage system. The 10V DC voltage is filtered by C810 and supplied to the + 5V line voltage regulator circuit.
3) In the second rectifier system, a half-wave rectifier circuit consisting of D811 and C813 rectifies AC voltage supplied from the third windings of the power transformer and provides with approx. 40V DC. This voltage is applied to the + 32V line voltage regulator circuit.
4) In the third rectifier system, a half-wave rectifier circuit consisting of D812 and C814 rectifies AC voltage supplied from the third windings of the power transformer and provides with approx. –40V DC. This voltage is input to the –30V and –28.5V voltage regulator circuits.

4-1-3 Voltage Regulator Circuits

(1) + 13.6V, + 12V regulator circuits

1) A description will be given on the + 12V regulator circuit as an example.
2) Q802 functions as an output transistor for the 12V line. The IC810 is the op-amplifier which works as an error voltage detector and amplifier, and controls the output of Q802.

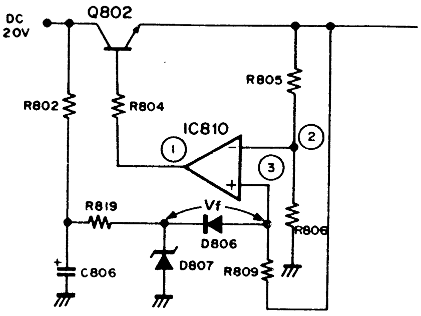


Fig. 4-1-2

3) A reference voltage for IC810 is provided as follows.
   Idling current is fed into the D807 (zener diode) through R802 and R819 from rectified voltage (20V) creating a constant voltage of 5V at the cathode side of D807.
4) The capacitor C806 works as a ripple filter and eliminates ripple components and stabilizes the zener voltage. Furthermore, the output voltage is applied to D806 through R809, allowing an idling current to flow in the diode D806. The forward voltage drop Vf resulting in this idling current is superimposed on the zener voltage, and this is used as the reference voltage for IC810. Voltage fluctuations caused in the output circuit is divided by R805 and R806, and fed back to IC810.
5) For example, assume that the output voltage of + 12V rises slightly, then the output feedback voltage ② also rises.
   Since the terminal ② of the op-amplifier is a (–) input, the output ① of the operational amplifier decreases. That is, the base bias voltage of Q802 decreases by amount equivalent to the increment of + 12V, thus keeping the output voltage at a specified value.
6) When the output voltage reduces, this circuit functions in the inverted manner.
7) + 13.6V (MB) regulator circuit also works in the similar way.

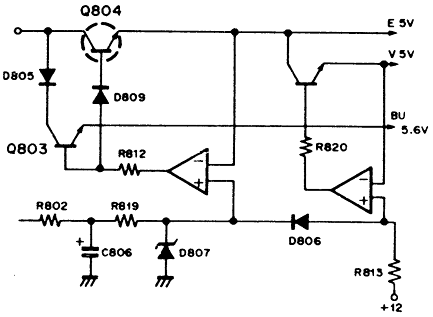
(2) E5V (Ever), V5V (Video), BU5.6V (Buck up) Voltage regulator circuits

1) D807 develops a zener voltage as a reference and this voltage is applied to the (+) terminal of the op-amplifier. As the E5V rises, (–) terminal of the op-amplifier also rises and this makes the output lower. Then, the base voltage of Q804 decreases, thus keeping the output voltage at a constant voltage.

2) In the BU5.6V line, the output voltage is determined as E5V + Vf of D809.

3) The V5V line is a switched output of the E5V.

Note: V5V stands for video 5V. BU5.6V means back up 5.6V.



Q804
E 5V
V 5V
BU 5.6V
D805
D809
Q803
R812
R820
R802
R819
C806
D807
D806
R813
+12

Fig. 4-1-3

(3) + 32V voltage regulator circuit

1) The rectified output in the 2nd rectifier system is fed to the PIF selector circuit through R860 (POWER-II UNIT) and the zener diode (= PC574) on the PIF selector circuit develops + 32V.

(4) −28.5V, −30V voltage regulator circuits

1) The rectified output in the 3rd rectifier system is applied to zener diodes D861 and D862 in passing through R862 and D860, and the zener diodes develop the −28.5V.

2) On the other hand the −30V is created by lowering the −28.5V by amount equivalent to Vf of D860 (approx. 1.5V).

4-1-4 Dew heater output circuit

1) The dew heater output obtains from the first rectifier system and is supplied through Q806 to the dew heater mounted on the cylinder.

2) When the cylinder motor is in stop or the power is off, a bias voltage is applied to Q806 base through D808 and R813 connected to the E5V line and Q806 turns on, thus allowing the dew heater current to flow into the dew heater.

3) When the power is on, the dew heater voltage is controlled by a control signal coming from pin 3 of P805.

4-1-5 Power on-off circuits

1) This circuit turns on or off + 13.6 (MB), + 12V, and V5V lines.

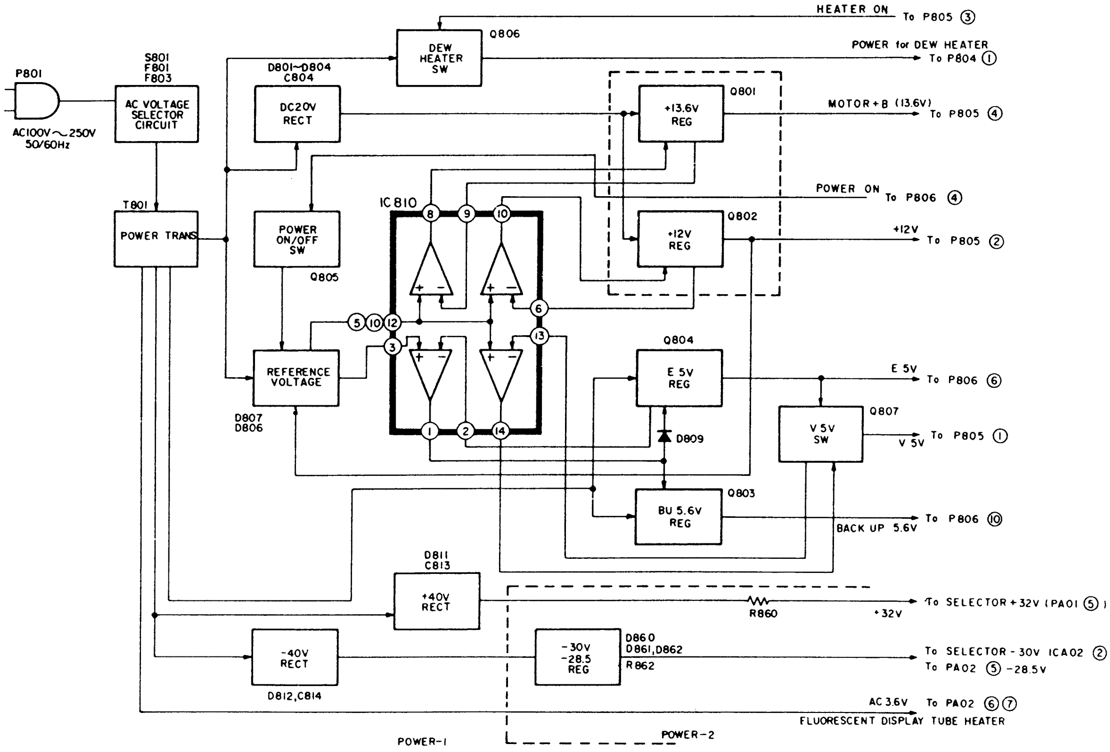
2) The control signal enters pin ④ of P806 and turns these voltage lines on when it is "L" level or turns off when "H" level.

3) When the control signal is "H", E5V is applied to the base of Q805 through R813 and turns Q805 on. Then, voltages at pins ⑤ , ⑩ , ⑫ of IC810 change to "L" level, lowering the reference voltage to zero volt. That is, voltages at pins ⑦ , ⑧ , ⑭ of the op-amplifier IC810 become "0" V, thus turning the + 13.6V, + 12V, and V5V line off.

4) When the control signal is "L", Q805 turns off because of its bias voltage disconnected and the reference voltage rises, thus switching in the + 13.6V, + 12V and V5V lines.

4-1-6 FL display tube heater power supply

1) The fourth winding of the power transformer supplies 3.6V AC as the heater power for the FL display tube.



HEATER ON To P805 ③
POWER for DEW HEATER To P804 ①
MOTOR+B (13.6V) To P805 ④
POWER ON To P806 ④
+12V To P805 ②
E 5V To P806 ⑥
V 5V To P805 ①
BACK UP 5.6V To P806 ⑩
To SELECTOR +32V (PA01 ⑤)
+32V
R860
To SELECTOR -30V (CA02 ②)
To PA02 ⑤ -28.5V
AC 3.6V To PA02 ⑥⑦
FLUORESCENT DISPLAY TUBE HEATER
P801
AC100V～250V 50/60Hz
S801 F801 F803
AC VOLTAGE SELECTOR CIRCUIT
T801
POWER TRANS
D801~D804 C804
DC20V RECT
DEW HEATER SW
Q806
POWER ON/OFF SW
Q805
REFERENCE VOLTAGE
D807 D806
IC810
+13.6V REG
Q801
+12V REG
Q802
E 5V REG
Q804
D809
V 5V SW
Q807
BU 5.6V REG
Q803
D811 C813
+40V RECT
-40V RECT
D812,C814
-30V -28.5 REG
D860 D861,D862 R862
POWER-1
POWER-2

Fig. 4-1-4

4-2 RF and Receiving Circuits

4-2-1 Outline

1) The receiving circuit consists of an ANT input circuit, channel selection circuit, PIF and SIF circuits. The receiving circuit selects a desired broadcast signal from TV signals induced on an antenna and sends stable video signal and audio signals obtained by processing program signals to the video and audio circuit.
2) The output signals from the video and audio circuits are converted to a conventional TV signal for the channel 3 or channel 4 by an RF modulator so that it can be received by conventional TV receivers.

4-2-2 ANT input & output circuits

1) In the circuits, a VHF distributer, an antenna switching circuit and a RF modulator are moduled into one unit.
2) The VHF distributer feeds TV signal from the antenna to either the VHF input of the tuner or the ANT switch.
3) In the ANT switch circuit one of the outputs from the RF modulator and the distributor is switched in by the TV/VCR switch. That is, with the switch placed in the TV position, the VHF output terminal provides the distributor output, and with the switch placed in the VCR position, the terminal develops the RF modulator output.
4) An UHF input is split by the distributer and send to the tuner input and the UHF output terminal.

4-2-3 PIF & SIF circuits

1) TV signal from the ANT input circuit enters the tuner. The tuner develops an IF signal corresponding to a channel selected in the channel selection circuit. The IF signal passes an IF filter (acoustic surface wave filter) and enters pins ①, ⑯ of IC002 (TA7607AP).
2) The IC002 developed its amplified and detected video signal at its pin ⑫ .
3) Thus developed output is split into two:
4) One enters the 4.5 MHz trap which passes through only a video signal, and the video signal passes through the sync expansion circuit, frequency response compensation circuit, and Q006 buffer, and reaches the video circuit.
5) The sync expansion circuit will expand the sync signal in the video signal, which is slightly compressed in detecting operation in IC002, by making use of a non-linear characteristic of the diode D001 connected to emitter of Q004 and the capacitor C013, thus compensating the sync signal to a proper level.
6) Another one of the video output split passes through a 4.5 MHz B.P.F and enters pin ② of IC003 (TA7337P).
7) The IC003 detects 4.5 MHz FM signal and obtains an audio signal. The audio signal develops from pin ⑨ and enters the audio circuit.

4-2-4 Channel selection circuit

(1) Outline

1) The channel selection circuit employs a voltage synthesizer (VS). The VS circuit consists of memory, ICA02 and a VS microcomputer ICA01.
2) Various information such as band selection & tuning voltage data required for channel selection, and data for AFT defeat, and audio muting are transferred serially between the timer microcomputer and the PIF circuit, and other display data are sent to the timer circuit.

(2) Functions

1) Channel setting mode
   The VS microcomputer sends real channel data relating to a band voltage display and a tuning voltage display obtained from the key matrix to the memories to keep the information. The VS microcomputer also sends the same kind of data to the timer circuit to display the information on the FL display tube.

2) Conventional reception mode
   a. In a conventional channel selecting operation, a channel data is read out from a memory by a channel position data sent from the timer circuit and the data is transferred to the timer section. Furthermore, a band voltage and a tuning voltage of the channel are sent to the PIF section.
   b. Band data is output through pins ㉘ ㉚ . They are indicated in Tables 4-2-1 and 4-2-2.
   c. The tuning voltage is output pulse from pin ⑱ . The pulse is pulse-modulated in 14 bit format. The tuning voltage is amplified by QA03 and then converted into a DC voltage in passing through a filtering network consisting of RA03, RA04, RA18, CA02, CA03, and CA12. Thus developed DC voltage is applied to V1 terminal of the tuner.
   d. Since noises occur at the time of channel switching, an audio muting pulse from pin ㉑ is applied to a switching circuit of QB04, to eliminate the noises.
   e. Pin ⑳ develops an AFT defeat pulse at the time of channel switching, and the pulse triggers the switching circuits of QB02 and QB01 which turn off the AFT at the moment of channel switching, thus preventing erroneous operation of the AFT.

(3) Channel setting (with AFT off)

1) When a channel setting is required with the AFT off, push the tuning buttons (+) and (—) in the conventional receive mode, and that position can be memorized with the AFT turned off. In this case, QA04 turns on and LED DA02 lights up.

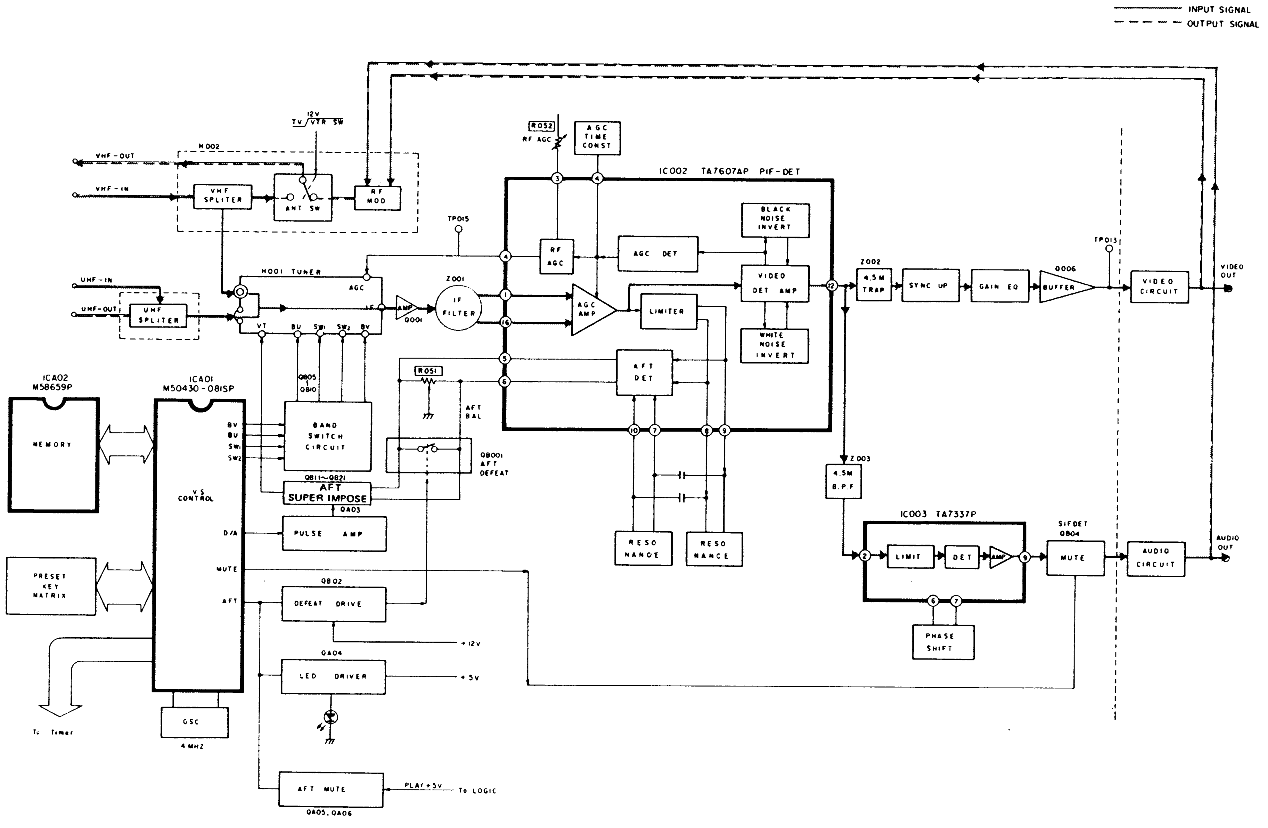

INPUT SIGNAL
OUTPUT SIGNAL
12V
TV/VTR SW
H002
VHF-OUT
VHF-IN
VHF SPLITER
ANT SW
RF MOD
UHF-IN
UHF-OUT
UHF SPLITER
H001 TUNER
AGC
IF
VT
BU
SW1
SW2
BV
AMP
Q001
TP015
Z001
IF FILTER
R052
RF AGC
AGC TIME CONST
IC002 TA7607AP PIF-DET
RF AGC
AGC DET
BLACK NOISE INVERT
VIDEO DET AMP
WHITE NOISE INVERT
AGC AMP
LIMITER
AFT DET
RESO NANCE
RESO NANCE
R051
AFT BAL
Q8001 AFT DEFEAT
Q805 ~ Q810
BAND SWITCH CIRCUIT
Q811~Q821
AFT SUPER IMPOSE
QA03
ICA02 M58659P
MEMORY
ICA01 M50430-081SP
VS CONTROL
BV
BU
SW1
SW2
D/A
MUTE
AFT
PULSE AMP
PRESET KEY MATRIX
Q802
DEFEAT DRIVE
+12V
QA04
LED DRIVER
+5V
To Timer
OSC
4 MHZ
AFT MUTE
QA05, QA06
PLAY+5V
To LOGIC
Z002
4.5M TRAP
SYNC UP
GAIN EQ
Q006
BUFFER
TP013
VIDEO CIRCUIT
VIDEO OUT
Z003
4.5M B.P.F
IC003 TA7337P
LIMIT
DET
AMP
PHASE SHIFT
SIFDET Q804
MUTE
AUDIO CIRCUIT
AUDIO OUT

Table 4-2-1 Band data

Computer terminal Band	Bv	Bu	SW1	SW2
VL	H	L	L	L
VH	H	L	H	L
U	L	H	L	L
CATV	H	L	H	H

Table 4-2-2 Tuner terminals and band data

Tuner terminal Band	Bv	Bu	SW1
VL	+12V (H)	Open (L)	23V (L)
VH	+12V (H)	Open (L)	0 (H)
U	Open (L)	+12V (H)	23V (L)

(   ): Microcomputer's terminal

4-3 Timer, Counter Circuits

4-3-1 Outline

1) The timer, channel selection, electronic counter, remote control (infrared) signal reception and the logic switch circuits consist of a microcomputer, TMP47C-410AN-6784 playing primarily roles in these circuits, FL display tube (FIP8QM7) indicating time, electronic counter value, channel, cassette type, tape speed, etc., operation key matrix and the remote control light signal reception circuit, and perform following operations; time count, timer recording, channel selection, reading key inputs, reading information from a wireless remote control unit, etc.

2) Different features from conventional models
   1) Conventional three microcomputers, each of which is relating to a timer, sublogic and main logic circuits, are replaced by two microcomputers (timer, logic circuit) which also perform operations conducted by the sublogic microcomputer so far.
   2) As new features, auto power on, auto play, and rewind shutoff functions are added.

4-3-2 Functions

(1) Clock

1 12 hours (AM/PM) digital clock

2 Automatic brightness switching by FL display tube (AM 6:00 – PM 9:59 bright, PM 10:00 – AM 5:59 dim)

(2) Programmable timer

1. 4 programs per week
2. Every day, every week or week days (Mon. through Sat.)
3. Tape speed selection using SP/EP key
4. One touch timer recording (Max. 4 hours)
5. Reserved program confirmation using the check key.

(3) Channel selection

1. Real channel display in 12 positions of 0 through 99.
2. Two button UP & DOWN system (on the VCR, wireless remote control unit)
3. Band and channel position indication in preset mode
   (Time display is switched for this indication)

(4) Electronic counter

1. 4 digit indication in FL display tube
   (Time display is switched for this indication. Count operation is performed in the logic microcomputer.)

(5) Input data reading

1. Data reading from key switches on the unit
2. Data reading from the wireless remote control unit

(6) Additional functions

1. Auto power on
   (Inserting a cassette turns the power on automatically.)
2. Auto play
   (Playback operation automatically starts after completion of tape rewind operation.)
3. Rewind shutoff
   (The power is automatically turned off after completion of tape rewind operation.)

4-3-4 Description of operation

(1) Operation keys

As can be seen in Fig. 4-3-1, 26 push switches and 2 slide switches control the timer, channel selection, logic mode, counter, and the power of the unit. In addition to this, wireless remote control codes are read through pin ㊲.

(2) Clock

1) The AC clock signal (utility power frequencv) supplied from the power transformer is first wave-shaped by the wave-shape & clamp circuits (DX01) and then applied to pin ㉟ of ICX01, timer microcomputer, through the buffer (QX02).
2) The clock operates in synchronization with this clock signal.

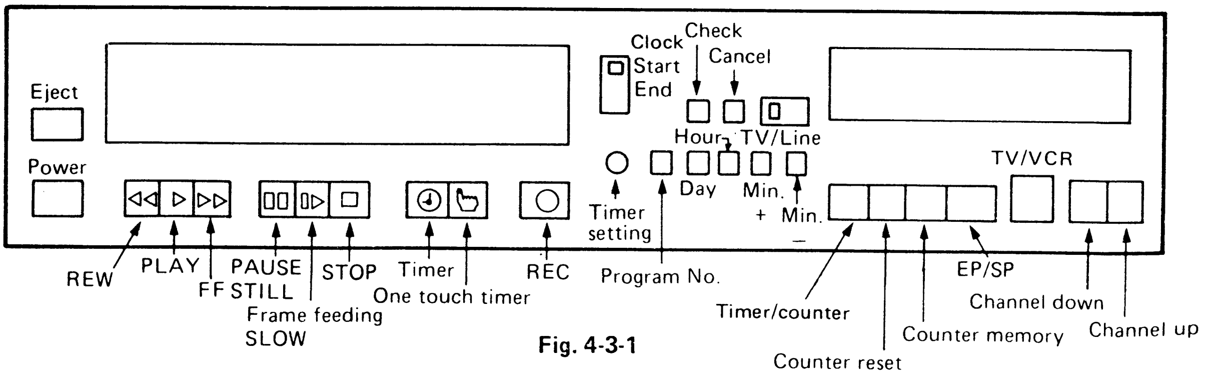


Fig. 4-3-1

(3) Channel selection

1) Channel selection is performed by the channel UP and DOWN keys on the unit or a channel position is determined by the wireless remote control unit.

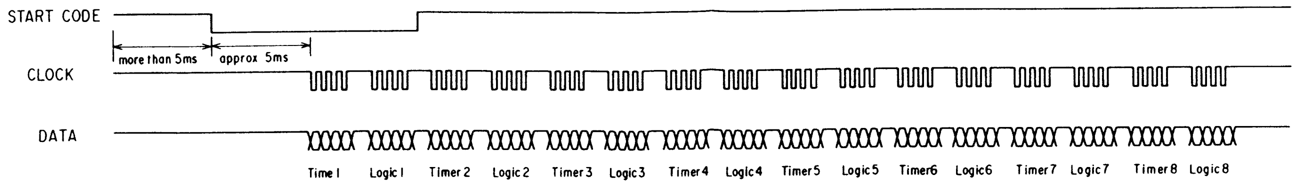
2) The channel selecting operation is conducted inside the ICA01 (M50430-81P) on the SELECT PC board. The ICA01 controls four bus lines for serial data transmitting. The ICX01 transmits a channel position data relating to the channel selected to ICA01, and the ICA01 transmits a real channel data and a band data to the ICX01, thus allowing the FL display tube to indicate the channel selected (0 – 99).

(4) Serial transmission

1) Data of 4 bits x 16 words are transmitted serially from or to the main logic circuit. This data transmission is performed eight times for every cycle of 30 msec starting from ICX01, IC601, ICX01, . . . alternately in this sequence. (Refer to the illustration shown below.)

2) When ICX01 develops first output, the start code is set to "L" and after the reception of first transmission from the IC601 the start code is set to "H".

3) In this serial transmission, the ICX01 transmits input key codes, power on, auto play, counter memory, counter values, etc. to the IC601, and the IC601 transmits power on off request signal, logic mode signal, counter values, etc. to the ICX01.


START CODE
CLOCK
DATA
more than 5ms
approx 5ms
Time1
Logic1
Timer2
Logic2
Timer3
Logic3
Timer4
Logic4
Timer5
Logic5
Timer6
Logic6
Timer7
Logic7
Timer8
Logic8

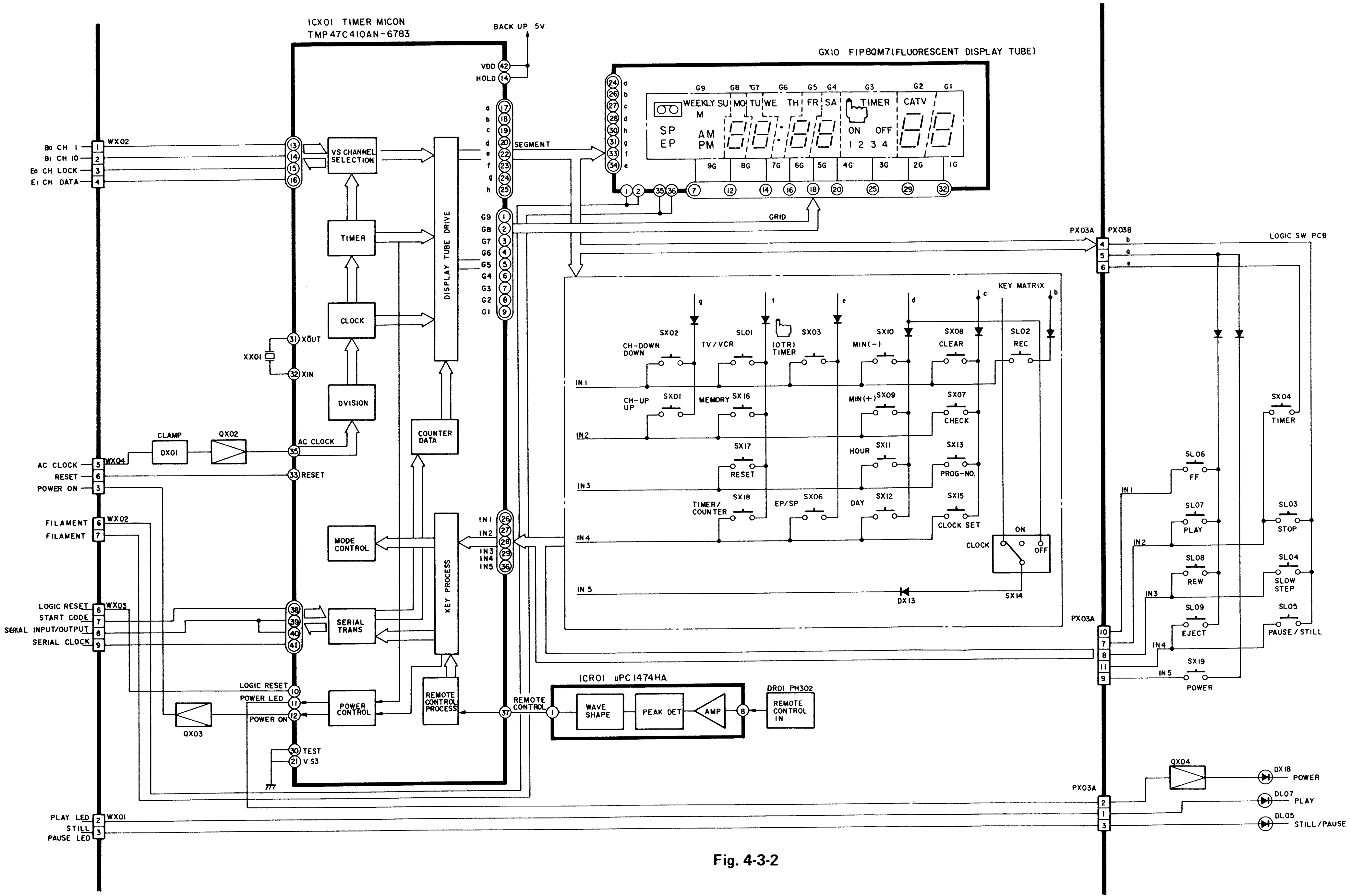

ICX01 TIMER MICON
TMP47C410AN-6783
BACK UP 5V
GX10 FIP8QM7(FLUORESCENT DISPLAY TUBE)
VDD
HOLD
B0 CH I
B1 CH IO
E0 CH LOCK
E1 CH DATA
WX02
VS CHANNEL SELECTION
TIMER
CLOCK
DVISION
DISPLAY TUBE DRIVE
SEGMENT
GRID
XOUT
XIN
XX01
CLAMP
DX01
QX02
AC CLOCK
RESET
POWER ON
WX04
COUNTER DATA
FILAMENT
MODE CONTROL
KEY PROCESS
IN1
IN2
IN3
IN4
IN5
LOGIC RESET
START CODE
SERIAL INPUT/OUTPUT
SERIAL CLOCK
WX03
SERIAL TRANS
LOGIC RESET
POWER LED
POWER ON
POWER CONTROL
REMOTE CONTROL PROCESS
QX03
TEST
VS3
REMOTE CONTROL
ICR01 uPC1474HA
WAVE SHAPE
PEAK DET
AMP
DR01 PH302
REMOTE CONTROL IN
PLAY LED
STILL
PAUSE LED
WX01
WEEKLY SU MO TU WE TH FR SA
TIMER
CATV
SP
EP
AM
PM
ON OFF
1 2 3 4
KEY MATRIX
SX02 CH-DOWN
SL01 TV/VCR
SX03 (OTR) TIMER
SX10 MIN(-)
SX08 CLEAR
SL02 REC
SX01 CH-UP
SX16 MEMORY
SX09 MIN(+)
SX07 CHECK
SX17 RESET
SX11 HOUR
SX13 PROG-NO.
SX18 TIMER/COUNTER
SX06 EP/SP
SX12 DAY
SX15 CLOCK SET
CLOCK
ON
OFF
SX14
DX13
PX03A
PX03B
LOGIC SW PCB
SX04 TIMER
SL06 FF
SL07 PLAY
SL03 STOP
SL08 REW
SL04 SLOW STEP
SL09 EJECT
SL05 PAUSE/STILL
SX19 POWER
QX04
DX18 POWER
DL07 PLAY
DL05 STILL/PAUSE

Fig. 4-3-2

(5) Electronic counter

1) Operation of the electronic counter is conducted inside IC601.
Counted values are transmitted serially and the content is displayed on the display tube.

(6) FL display tube

- Time, content of timer reserved programs, or a counter value is switched and displayed.
- Furthermore, cassette, counter memory, and a real channel selected are displayed.
- A dynamic drive system which lights up each digit segment sequentially with grid pulses and segment pulses sent from the microcomputer is employed in the FL display tube.
- The FL display tube is of triode type and lights up when both of the grid voltage Ec and the plate voltage Eb become +27V against the filament center voltage (–22V).
- To turn off the display tube, Ec or Eb must be lowered to 6V below the filament voltage.

(7) Power failure compensation

1) If power failure occurs, content of reserved programs, etc. will be maintained if the failure is resumed within about 10 minutes.
The display tube turns off during the power failure but its colon will blink after the failure is resumed.

(8) Additional function

1) Auto power on

Loading a cassette turns the power on automatically, if the power is turned off.

2) Auto play

When the PLAY key is pushed with the REW key during rewind operation, the auto PLAY mode is set and the playback LED lights up. And the PLAY mode is automatically set when the rewind operation completes.
The auto play mode does not work with the wireless remote control unit.

3) Rewind shut off

Pushing the power key (on the VCR or the remote control unit) during rewind operation actuates this function. The power LED starts blinking and the power is automatically shut off when the rewind operation completes.

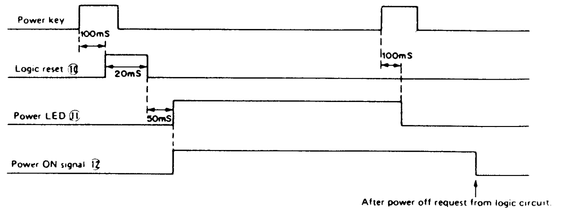

Power key
100mS
Logic reset
20mS
Power LED
50mS
Power ON signal
100mS
After power off request from logic circuit

Fig. 4-3-3

4-4 Logic Circuits

4-4-1 Outline

1) The logic circuit consists of two microcomputers TMP4746N5760 (for system control . . . . herein after called logic microcomputer) and TMP47410AN6783 (for button operation, remote control processing, etc. . . . . herein after called timer microcomputer), servo logic unit which performs the system control, timer unit which controls each mode operation and the LED indication, and the logic switch unit.
2) Mechanism control for each mode is conducted with a cam system. A slot-in mechanism is employed for tape loading. Controls for these mechanisms are performed by the electronic logic operations using the microcomputers stated above.
3) Fig. 4-4-3 shows the system block diagram of the logic circuit.

4-4-2 Functions

(1) Mode operation

Fig. 4-4-2 shows a mode shift diagram.

Operation of each button is accepted through the routine shown in Fig. 4-4-1. During the mode shift operation, IC601 performs the system control as follows:

1) Determines an operation mode by analyzing input signals from the operation button(s) and sensor switches provided to detect abnormal operation, etc.
2) Performs the mode LED display and the counter control and sends the counted value to ICX01.
3) Controls servo systems (servo ICs, cylinder motor and capstan motor).
4) Controls audio and video systems (head switching, mode +B, and muting signals)
5) Controls the loading motor to set a desired cam position, thus controlling the mechanism system. (Output: pins (60), (61), (62), (63) of IC601)
(Input : pins ⑮, ⑯ of IC601)
6) Controls the reel motor.

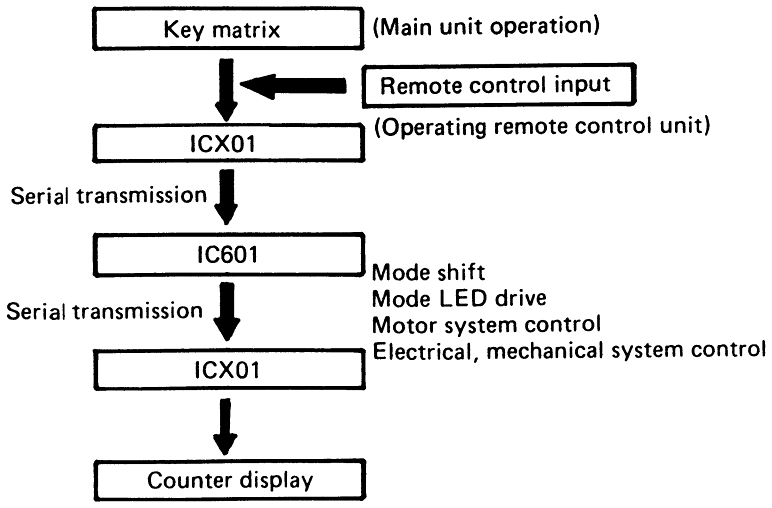

Key matrix
(Main unit operation)
Remote control input
(Operating remote control unit)
ICX01
Serial transmission
IC601
Mode shift
Mode LED drive
Motor system control
Electrical, mechanical system control
Serial transmission
ICX01
Counter display

Fig. 4-4-1 Mode shift

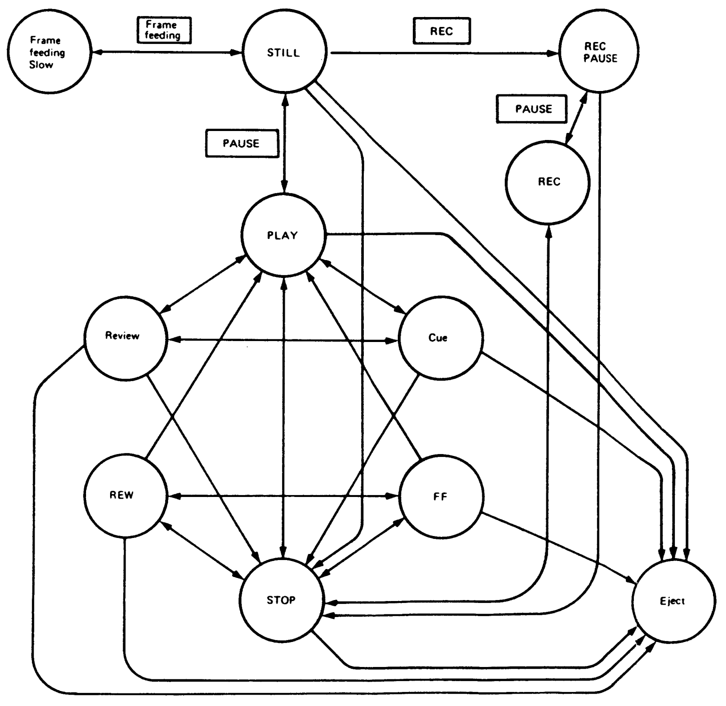

Frame feeding Slow
Frame feeding
STILL
REC
REC PAUSE
PAUSE
PAUSE
REC
PLAY
Review
Cue
REW
FF
STOP
Eject

Fig. 4-4-2 Mode shift diagram

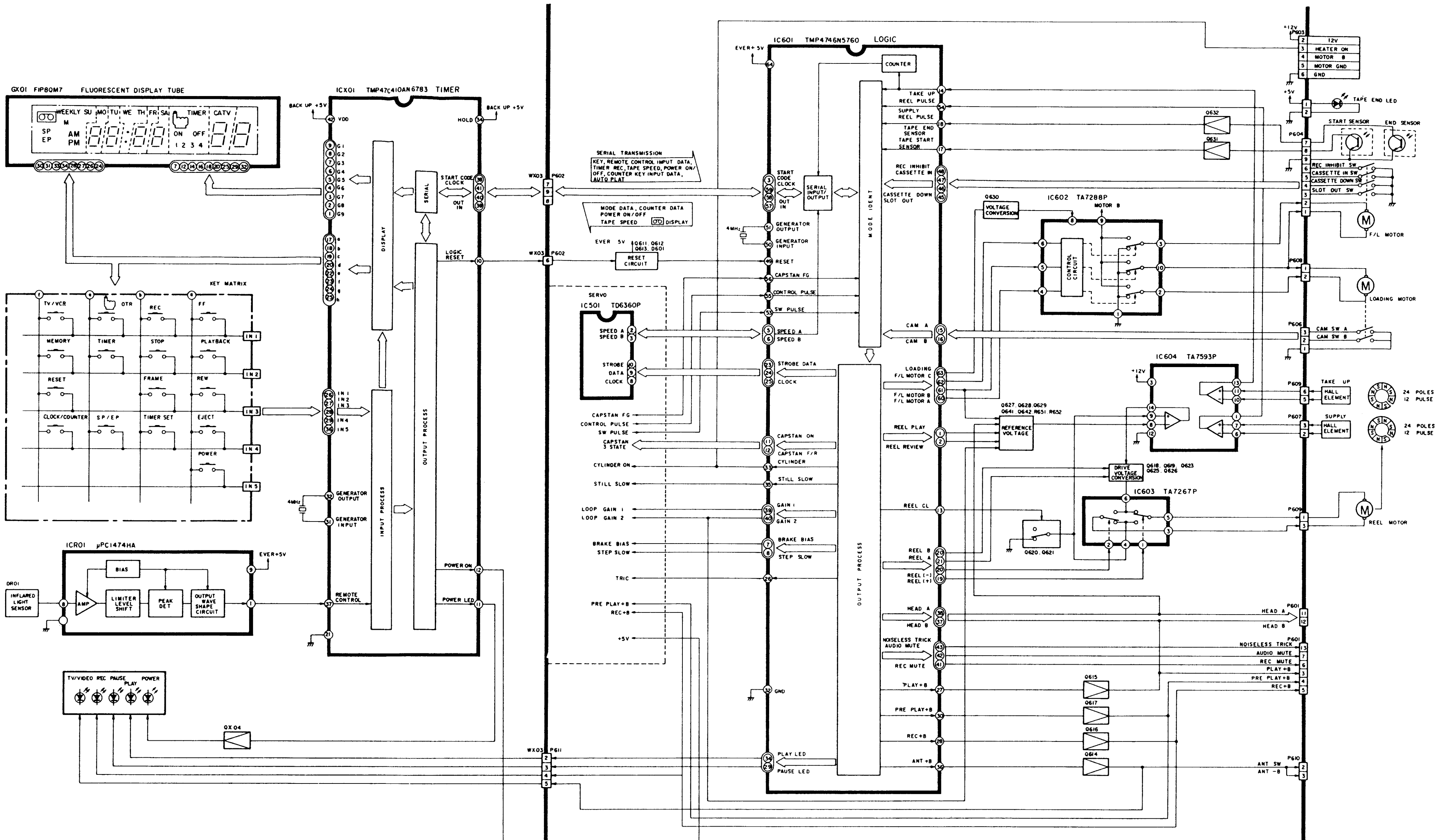

GX01 FIP80M7 FLUORESCENT DISPLAY TUBE
ICX01 TMP47C410AN6783 TIMER
KEY MATRIX
TV/VCR
OTR
REC
FF
MEMORY
TIMER
STOP
PLAYBACK
RESET
FRAME
REW
CLOCK/COUNTER
SP/EP
TIMER SET
EJECT
POWER
ICR01 μPC1474HA
BIAS
AMP
LIMITER LEVEL SHIFT
PEAK DET
OUTPUT WAVE SHAPE CIRCUIT
INFLARED LIGHT SENSOR
DISPLAY
SERIAL
INPUT PROCESS
OUTPUT PROCESS
GENERATOR OUTPUT
GENERATOR INPUT
LOGIC RESET
POWER ON
POWER LED
REMOTE CONTROL
SERIAL TRANSMISSION
MODE DATA, COUNTER DATA
RESET CIRCUIT
SERVO
IC501 TD6360P
SPEED A
SPEED B
STROBE DATA
CLOCK
IC601 TMP4746N5760 LOGIC
COUNTER
TAKE UP REEL PULSE
SUPPLY REEL PULSE
TAPE END SENSOR
TAPE START SENSOR
REC INHIBIT
CASSETTE IN
CASSETTE DOWN
SLOT OUT
CAPSTAN FG
CONTROL PULSE
SW PULSE
CAPSTAN ON
CAPSTAN F/R
CYLINDER
STILL SLOW
GAIN 1
GAIN 2
BRAKE BIAS
STEP SLOW
MODE IDENT
OUTPUT PROCESS
CAM A
CAM B
LOADING MOTOR
F/L MOTOR
REEL PLAY
REEL REVIEW
REEL CL
HEAD A
HEAD B
NOISELESS TRICK
AUDIO MUTE
REC MUTE
PLAY+B
PRE PLAY+B
REC+B
ANT+B
PLAY LED
PAUSE LED
IC602 TA7288P
VOLTAGE CONVERSION
CONTROL CIRCUIT
IC604 TA7593P
REFERENCE VOLTAGE
HALL ELEMENT
IC603 TA7267P
DRIVE VOLTAGE CONVERSION
12V
HEATER ON
MOTOR B
MOTOR GND
GND
TAPE END LED
START SENSOR
END SENSOR
REC INHIBIT SW
CASSETTE IN SW
CASSETTE DOWN SW
SLOT OUT SW
F/L MOTOR
LOADING MOTOR
CAM SW A
CAM SW B
TAKE UP
SUPPLY
24 POLES 12 PULSE
REEL MOTOR
ANT SW
POWER SW
EVER+5V

Fig. 4-4-3 Logic circuit system block diagram

(2) Slot mechanism control

Input : Pins ㊺, ㊻, ㊼, ⑰, ⑱ of IC601
Output: Pins (60), (61), (62) of IC601

1) During cassette loading or unloading operation, IC601 checks status of three FL-SW (cassette in ㊼, cassette down ㊻, and slot out ㊺) and controls the FL motor.
2) IC601 also checks status of tape end sensors (tape start sensor ⑰ and tape end sensor ⑱) after the cassette is moved down and performs the eject operation if no cassette is loaded.

(3) Loading mechanism control

Input : Pins ⑮, ⑯ of IC601
Output: Pins (60), (61), (62), (63) of IC601

1) During loading, unloading or cam position transitional period, IC601 checks status of the cam switches (Cam A ⑮, Cam B ⑯) and controls the loading motor.

(4) Tape end detection (tape start)

Input : Pin ⑰ of IC601

1) When tape start position is detected in a rewind mode or review mode, the rewind operation is stopped and a short length of tape is wound in forward direction.
2) When tape start position is detected in a forward mode, a short length of tape is rewound and then the unit enters that mode.

(5) Tape end detection (tape end)

Input : Pin ⑱ of IC601

1) When the tape end is detected during forward modes such as playback, recording, etc., the tape is automatically rewound.
   (In the timer recording mode, the rewind operation is not performed but the unit enters the stop mode and the power is automatically shut off.)

(6) TV/VCR switching

Output: Pin ㊱ of IC601

1) When playback mode is set, the VCR position is automatically selected.
2) With the power turned on, pushing the TV/VCR button selects alternately the TV or the VCR mode.

(7) Accidental erase prevention

Input: Pin ㊻ of IC601

1) If a cassette with its safety tab removed is loaded, the record mode can not be set, and when the REC button is pushed the cassette is automatically ejected.

(8) Timer recording

Input: Serial transferring

1) The timer recording mode is set with the timer recording input sent from the timer microcomputer ICX01.
   During the timer recording mode any operation buttons other than the TV/VCR are not accepted.

(9) Synchronous editing

1) After completion of the following mode change operations (from record to stop or record pause; from still to record pause or timer record), tape is slightly rewound to allow overlap recording for that area.

(10) Counter memory

1) When fast forward or rewind operation is performed with the counter memory mode actuated, the VCR stops automatically when the counter reaches "0000". To increase accuracy of stop position of the tape, output from pin ㉑ of IC601 is controlled in terms of PWM so that the rotating speed of the reel is slow down at a location preceded by 200 count pulses from the zero stop position.

(11) Speed control in FF and REW modes

1) To prevent tape damage at around the tape end in the FF or REW mode, output at pin ㉑ of IC601 is controlled in terms of PWM to slow down rotating speed of the reels.

(12) Auto play

1) When the PLAY button is pushed with the REW button during rewind mode, auto play mode is set and the playback LED blinks at a rate of lHz.
2) If the counter memory mode is set, playback mode is automatically set after the zero stop operation.
3) The playback operation starts automatically after detection of a tape start position.

(13) Rewind shut off

1) Pushing the POWER button during the rewind mode set the rewind shut off mode and the power LED blinks at a rate of lHz.
   When the rewind operation completes, the power is automatically turned off.

(14) Auto power on

1) When a cassette is newly loaded under the power off condition, the power is automatically turned on and the cassette is slotted in and loaded.

(15) Audio muting

Output: Pin ㊷ of IC601

1) Audio signals are muted during the slow, still, and picture search operations.

(16) Automatic mode release

1) To protect tape from damage the still, slow, or the record pause mode is automatically released after a specified time as shown in Table 4-4-1 below.

(17) Abnormal reel rotation detection

Input: Pins ⑭, (54) of IC601

1) If rotational pulses from the take-up reel or supply reel do not enter for a specified period determined for each mode as shown in Table 4-4-2, IC601 assumes there may be some troubles in the mechanism, etc and sets the stop mode.
   If abnormality is detected during timer recording, the power is automatically turned off.

(18) Abnormal cylinder rotation detection

Input: Input: Pin (53) of IC601

1) If switching pulses do not enter to pin (53) of IC601 for approx. 3 seconds with the cylinder motor rotating, the VCR enters the stop mode. However, when abnormality is found during timer recording, the power is shut off.

(19) Motor protection

Provisions for motor protection is provided as shown in Table 4-4-3.

Table 4-4-1 Automatic mode release time

Mode	Released after:	Mode after released
Still/Slow	Approx. 5 min.	Playback
Rec·Pause	Approx. 10 min.	Stop

Table 4-4-2 Reel abnormal rotation detection time

Modes	T side	S side
FF	Approx. 2 sec.	Approx. 3.5 sec
REW	Approx. 3.5 sec.	–
CUE	Approx. 2 sec.	–
Review	Approx. 3.5 sec.	Approx. 3.5 sec.
PLAY	Approx. 2.5 sec.	–
SLOW	Approx. 20 sec.	–
REC	Approx. 2.5 sec.	–
Unloading	–	Approx. 1.8 sec.

Table 4-4-3 Motor protection function

Mode	Abnormal operation	Abnormality detection time	Operation made shifts to:
Slot in	Cassette in SW Off.	Approx. 0.5 sec.	Slot out
	Cassette does not move down.	Approx. 3 sec.	Slot out
Slot out	Cassette does not move out.	Approx. 3 sec.	Slot in
Slot in after abnormality detected in slot out operation.	Cassette does not move down.	Approx. 3 sec.	Power turned off after slot motor was stopped.
Loading	Cam does not move to its correct position.	Approx. 10 sec.	Power turned off after loading motor was stopped.
Unloading	Cam does not move to its correct position.	Approx. 10 sec.	Power turned off after loading motor was stopped.

4-5 Servo Circuits

4-5-1 Outline

1) In the servo circuit, a digital servo IC (TD6360P) functions a primary role and controls the cylinder motor and the capstan motor. The servo circuit consists of various functional blocks as shown in Table 4-5-1.

4-5-2 Servo ICs

1) The servo IC, TD6360P is a 24 pin shrink type IC which has been newly developed for VHS format by TOSHIBA and has following functions:
   1 Cylinder system processing circuits: phase detection, speed detection, reference signal generation
   2 Capstan system processing circuits : phase detection, speed detection, reference signal generation
   3 Automatic tape speed (SP mode, EP mode) discrimination in playback mode
   4 Tape speed designation in record mode
   5 Capstan speed control in special speeds (1/3, 1/2, 1, 2, 3, ... 15 times the normal speed), cylinder fH correction circuit
   6 Synchronous editing function

2) Pin configuration is almost the same as that of TD6314P, but differs in that the function 5 shown above was added and the mode designation is conducted by serial data inputs to pins ⑧ – ⑩.

Table 4-5-1 Servo circuit configuration

Function	Circuits included
1 Cylinder servo circuit	PG signal wave-shape circuit, PG signal shift circuit, Switching pulse wave-shave circuit, AFC circuit, APC circuit
2 Capstan servo circuit	FG pulse wave-shape circuit, Multiplication circuit, CTL amplifier, AFC circuit, APC circuit, Tracking shift circuit, Tape speed circuit, Switching circuit
3 Intermittent slow circuit	CTL delay circuit, Capstan intermittent drive circuit, Horizontal swing compensation circuit
4 Others	V sync separation circuit, Pseudo V sync circuit

4-5-3 Cylinder servo circuit

The cylinder servo circuit controls rotational speed and phase of the video heads so that video signals can be recorded on specified video track correctly in the record mode and the heads can precisely trace on the recorded patterns in playback mode.

(1) Head assembly

1) Fig. 4-5-1 shows an arrangement of the video heads on a cylinder. As can be seen from the illustration, four heads are mounted on the cylinder.
2) Since the SP (Standard Play) and EP (Extended Play) heads are mounted with a distance equivalent to 2H (H= 63.5μsec) apart, different switching pulses are needed for each SP and EP mode.
   Furthermore, in playback LP mode, the EP heads are used.

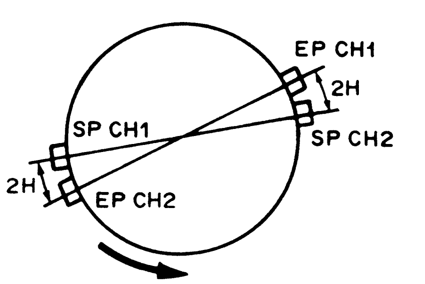

EP CH1
2H
SP CH2
SP CH1
2H
EP CH2

Fig. 4-5-1 Video head arrangement

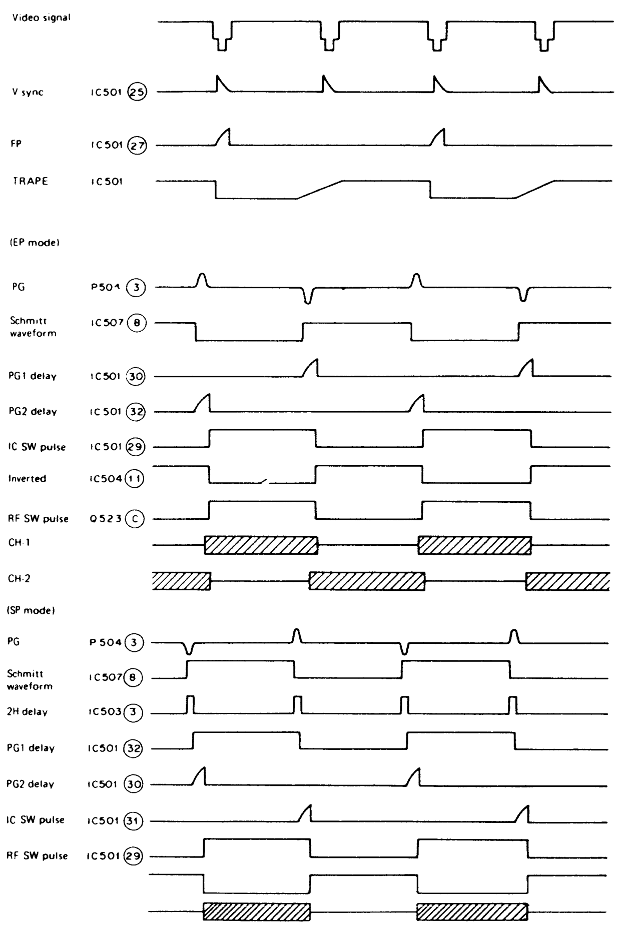


Fig. 4-5-2 SW pulse timing chart

(2) PG and SW pulse generation circuits

1) The PG pulse is created by detecting rotation of the PG magnets mounted on the lower part of the cylinder with the fixed PG heads. In the SP mode, the PG pulse is set approx. 0.8 msec before head switching point. Fig. 4-5-2 shows the timing chart.
2) The PG signal induced on the PG heads is waveshaped in the Schmitt circuit of IC507 (pins ⑧ – ⑩) and then sent to the PG shifter consisting of IC503. The PG shifter is provided to correct a mounting position between the EP heads and the SP heads in the SP mode, and no correction is performed in the EP mode, Que/Review, slow, and trick play mode of operations.
3) Fig. 4-5-3 shows a timing chart for the PG shifter The PG pulse waveshaped in the Schmitt circuit is then converted to a pulse with approx. 1.5 msec width inside the IC503 (pins ⑧ – ⑩). IC503 and D518 create a 2H-delay pulse at each rising edge of the 1.5mm sec width pulse. This delayed pulse is mixed with the Schmitt output in IC503 (pins ⑪ – ⑬) during the record or playback mode in the SP mode, thus creating a 2H delayed SW pulse.
4) On the other hand, in the EP mode or a special playback mode, pin ⑪ of IC503 develops an output same as the Schmitt circuit output (in phase) due to D523 and D524 and is applied to pin ㉜ of IC501. Inside IC501, the signal is delayed with R551 and R552, and developed from pin ㉙ of IC501 as a rectangular output, inverted by IC504 (pins ⑪ – ⑬) in only the EP mode, and then fed to the video circuit through the buffer Q523.

(3) Phase detection (APC), speed detection (AFC)

1) The phase detection and the speed detection are conducted inside IC501.
2) In the phase detection, the switching pulse created from the PG pulse as previously described is compared with a reference signal in their phases. In the record mode, a vertical sync signal separated from video signals is counted down to half and the resultant signal is used as the reference signal. The vertical sync signal is applied to pin ㉕ of IC501.
3) On the other hand, in the playback mode the internal reference signal of 30Hz, which is created from the clock signal of 3.58 MHz applied to pin ㊶ of IC501, is used as the reference signal. This is the only difference observed between the record and play modes in the cylinder servo operation.

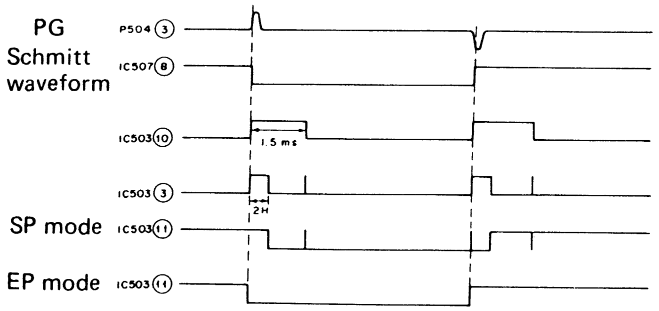


Fig. 4-5-3

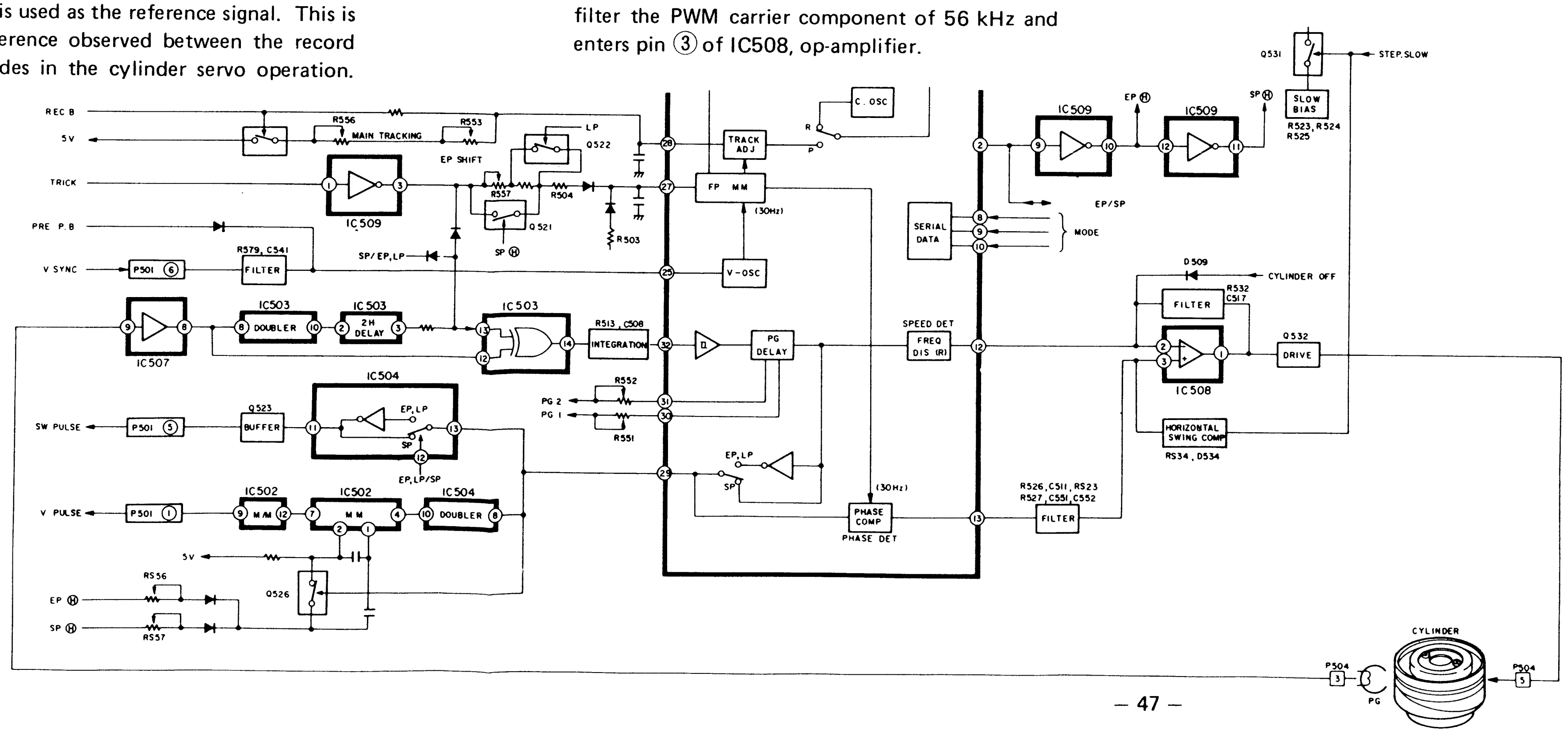
4) These reference signals are synchronized with rising edge of the delayed waveform at pin ㉗ (FP) of IC507.
5) In the speed detection circuit rising and falling time of the switching pulse (speed or time difference) is compared.
6) Results of the phase and speed detections are output from pins ⑬ and ⑫ of IC501 as 56 kHz rectangular pulse signals modulated in pulse width (PWM).
7) When the servo is locked under the stabilized condition, the PWM output shows about 50% duty, but when excessive speed and/or phase variations are caused the duty may vary considerably and in the worst case the output becomes constant high or low level.
8) However, if the rotating speed of the cylinder deviates considerably (in this case the AFC output becomes high or low) the duty of the APC output is maintained at 50%, so care must be needed.

(4) Phase compensation and output amplifier circuits

1) The output from pin ⑬ of IC501 passes through a filter (R526, C511, RS23, R527, C551, C552) provided to stabilize the servo response and to filter the PWM carrier component of 56 kHz and enters pin ③ of IC508, op-amplifier.
2) The double throw diode D506 connected parallel RS23 is provided to enhance quick charging or discharging of C551 and C552 in transient time period.
3) The AFC output from pin ⑫ of IC501 enters pin ② of IC508. The carrier component of the AFC output is removed by the feedback capacitor C516 connected to pins ①, ② of IC508.
4) R532 and C517 determine the gain of the op-amplifier as well as, they constitute a filter for APC and AFC.
5) The op-amplifier output enters the base of drive transistor and drives the cylinder motor. To stop the cylinder motor, approx. 3.5V is applied to pin ② of IC508 through D509 and the op-amplifier output goes low.

(5) fH correction

1) In the cue/review mode, tape travels rapidly. Accordingly, it is necessary to decrease or increase the rotating speed of the cylinder in response to the tape speed to keep relative tape speed between the cylinder and the tape at the specified value or to obtain horizontal sync frequency of 15.734 kHz.
2) This cylinder speed is automatically increased or decreased according to the speed command sent from the microcomputer to pins ⑧ – ⑩ of TD-6360P, thereby correcting the fH within 15.734 kHz ± 80 Hz.
3) In the cue/review mode, duty variation of the PWM signal developed at pins ⑫, ⑬ of IC501 can be observed as the tape speed varies.


REC 8
5V
TRICK
PRE P.B
V SYNC
SW PULSE
V PULSE
EP Ⓗ
SP Ⓗ
R556
R557
MAIN TRACKING
R553
LP
Q522
EP SHIFT
R504
Q521
R503
IC509
R579, C541
FILTER
P501 ⑥
SP/EP,LP
IC507
IC503
DOUBLER
2H DELAY
IC504
EP,LP
SP
Q523
BUFFER
P501 ⑤
P501 ①
IC502
M M
DOUBLER
EP,LP/SP
Q526
R513, C508
INTEGRATION
PG 2
PG 1
R552
R551
C. OSC
TRACK ADJ
FP MM
(30Hz)
V-OSC
PG DELAY
SERIAL DATA
MODE
EP/SP
SPEED DET
FREQ DIS (R)
PHASE COMP
PHASE DET
Q531
STEP.SLOW
SLOW BIAS
R523, R524
R525
D509
CYLINDER OFF
R532
C517
IC508
Q532
DRIVE
HORIZONTAL SWING COMP
R534, D534
R526, C511, RS23
R527, C551, C552
CYLINDER
P504 ③
P504 ⑤
PG

4-5-4 Capstan servo circuit

In the capstan system, speed control from 1/10 intermittent slow to cue/review modes is conducted using a direct drive motor. Fig. 4-5-5 shows the timing chart in record mode and Fig. 4-5-6 shows the timing chart in playback mode.

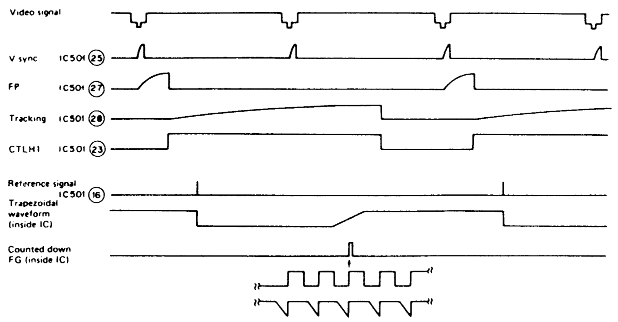
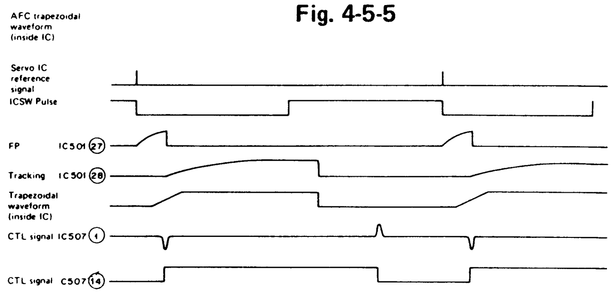


Fig. 4-5-5



AFC is the same as one in Rec mode

Fig. 4-5-6

(1) FG signal generator

1) The FG signal is a signal obtained from the capstan motor as a speed feedback signal of the capstan.
2) The FG signal is created by detecting a voltage induced on the pattern coil of a PC board when the FG magnets mounted on outside of the motor coil round on the pattern coil.
3) The FG pulse induced on the coil is fed to the servo circuit from pin ① of P503. The number of the FG pulses developed per one revolution of the motor in normal playback or record mode with the servo locked is 720 Hz in the SP mode and 360 Hz in LP mode and 240Hz in the EP mode.
4) These pulses are first amplified by IC507 (pins ⑤ – ⑦), waveshaped in IC604 (pins ②, ④, ⑤) in the logic circuit , and then applied to the multiplication circuit which will be described later and to pin ⑤ of IC501.

(2) Tracking circuit

1) Adjustment of phase difference between the SW pulse and CTL pulse or tracking adjustment can be performed by adjusting R553 and the main tracking control connected to pin ㉘ of IC501.
2) Since this VCR has equipped with a clean slow function which needs the control (CTL) signal as large as possible when a tape is traveling at a constant speed, as described later, position of the CTL head is shifted from the normal position specified. So recorded tape will not meet the specifications if recording is made directly under this condition. To correct this, it is necessary to shift the CTL signal and the tracking in play mode by the amount equivalent to the shifted distance of the CTL head position.
3) The amount of the shift is determined by the delay time determined with C502 and associated resistance at pin ㉗ of IC501, frame pulse terminal.

(3) Control (CTL) signal recording

1) In recording, a vertical sync signal enters pin ㉕ of IC501, and from this, 30 Hz control signal is created and applied to the control head through pins ㉒ , ㉓ . The CTL pulse is recorded on the control track of the video tape in saturation level.
R510 functions to limit the recording current to approx. 3 mApp.
2) Duty of the record CTL pulse is determined by the tracking delay time at pin ㉘ of IC501 and has been set to approx. 70% by R501 and C501.

(4) Playback CTL pulse amplifier circuit

1) In playback mode, pin ㉒ of IC501 is open and a bias voltage of approx. 2.2V is developed at pin ㉓ of IC501 to bias one terminal of the CTL head.
2) The playback CTL pulse is amplified by IC507 (① – ③), wave-shaped by IC507 (⑫ – ⑭), divided to voltage of approx. 3.8V by R589 and R538, and finally applied to pin ⑳ of IC501.

(5) Phase detection (inside servo IC)

(RECORD mode):

1) The FG pulse signal entered pin ⑤ of IC501 is counted down to 1/8 or 1/24 to create 30 Hz pulse in the EP and the SP mode, and compared with the reference signal in their time difference (phase detection) in the phase comparator. The compared output is developed from pin ⑭ as a 56 kHz PWM signal.
2) The reference signal is the 30 Hz signal developed inside the IC for exclusive use of the capstan control and output to pin ⑯ as a positive pulse signal.

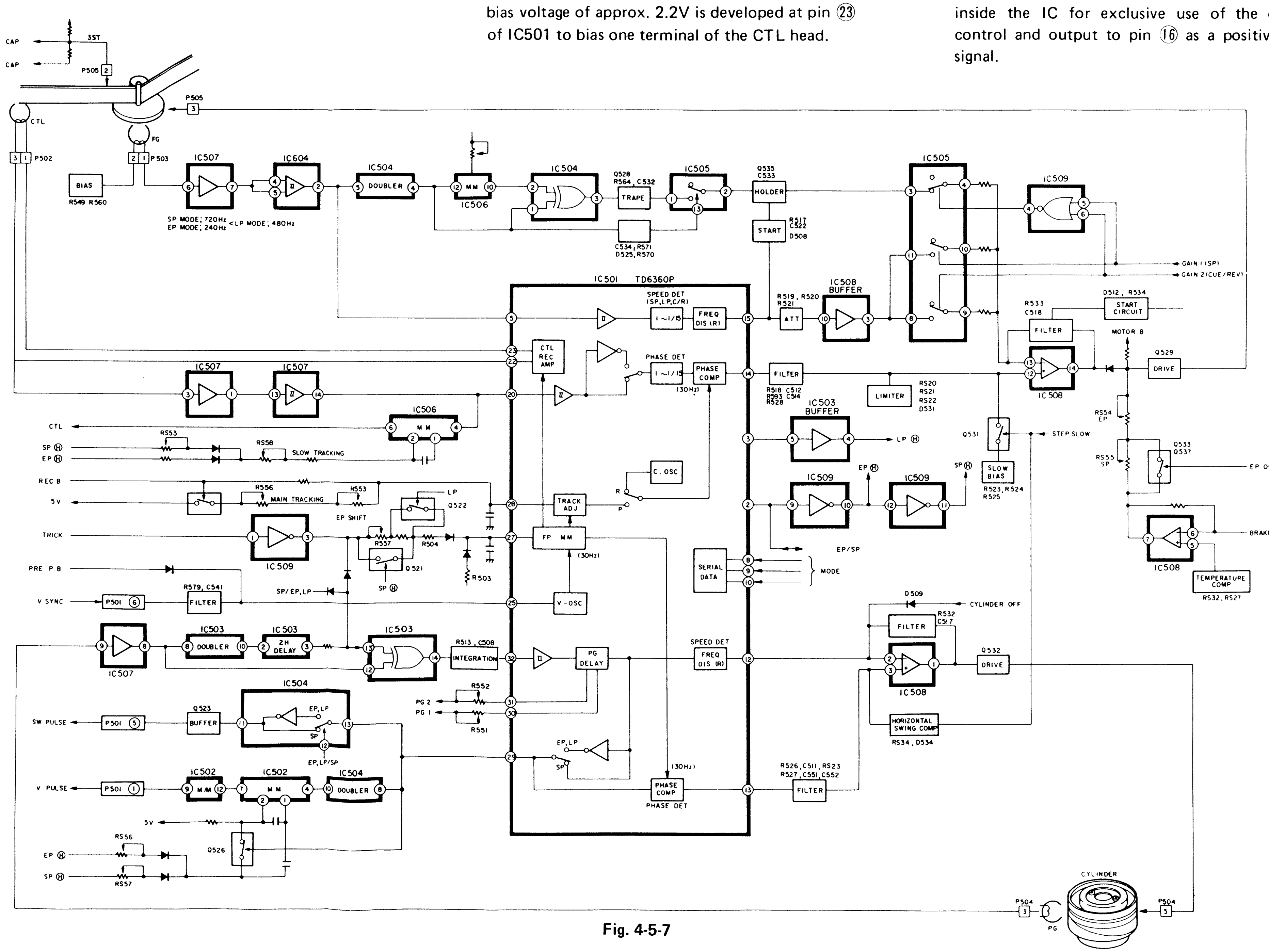

CAP
CAP
3ST
P505
CTL
FG
P502
P503
BIAS
R549 R560
IC507
IC604
SP MODE; 720Hz
EP MODE; 240Hz
LP MODE; 480Hz
IC504
DOUBLER
MM
IC506
TRAPE
IC505
HOLDER
START
IC509
GAIN 1(SP)
GAIN 2(CUE/REV)
IC501 TD6360P
SPEED DET (SP,LP,C/R)
FREQ DIS (R)
PHASE DET
PHASE COMP
(30Hz)
CTL REC AMP
IC508 BUFFER
ATT
START CIRCUIT
MOTOR
FILTER
DRIVE
LIMITER
IC503 BUFFER
LP
STEP SLOW
SLOW BIAS
EP ON
BRAKE PULSE
TEMPERATURE COMP
CTL
SP
EP
REC
5V
TRICK
PRE P B
V SYNC
SLOW TRACKING
MAIN TRACKING
EP SHIFT
TRACK ADJ
FP MM
C. OSC
SERIAL DATA
MODE
EP/SP
V-OSC
CYLINDER OFF
P501
FILTER
SP/EP,LP
DOUBLER
2H DELAY
INTEGRATION
PG DELAY
SPEED DET
FREQ DIS (R)
HORIZONTAL SWING COMP
SW PULSE
BUFFER
EP,LP
PG 2
PG 1
PHASE COMP
PHASE DET
V PULSE
IC502
CYLINDER
PG
P504

Fig. 4-5-7

(PLAY mode):

3) The CTL pulse signal entered pin ⑳ of IC501 and the reference signal delayed in IC501 (pins ㉖, ㉗) are compared in their phases and the resultant output is developed from pin ⑭ as a PWM output signal.
4) The duty of the PWM signal is forced to 50% if the servo response is disturbed in the record or playback mode as in the cylinder servo circuit.

(6) Speed detection (inside servo IC)

1) The FG signal entered pin ⑤ of servo IC501 is compared in its speed in the speed detector circuit and the resultant AFC output is output from pin ⑮ in terms of PWM output. The PWM output is used to control speed in either record or playback operation in the SP mode and the Cue/Review mode.
2) In the EP mode, a discrete type AFC circuit is used for both record and playback operation as described later.

(7) Discrete AFC circuit (EP mode)

1) In the EP mode, the AFC loop requires a wider frequency response than that in the SP mode, and a discrete type AFC circuit based on 480 Hz sampling is provided to improve frequency response of the loop in addition to the IC501.
2) Fig. 4-5-8 indicates the timing chart for the discrete type AFC circuit.
3) The FG signal wave-shaped in IC604 is multiplied by (pins ④ – ⑦), applied to IC506 (pin ⑫) and delayed. The amount of delay time determines the AFC frequency and can be adjusted by R554.
4) Both the multiplied and delayed waveforms are mixed in IC504 (pins ① – ③), converted to a trapezoidal wave in R564, C532. The trapezoidal wave enters the buffer and then sampled in IC505 (pins ①, ②).
5) The gate pulse for the sampling is created by differentiating the multiplied wave stated previously with C534 and R571.
6) The sampled output is held by Q535 and C533, and applied to pin ③ of IC505.
7) A filtered output of pin ⑮ of IC501 is applied to the gate of Q535 through D508. This makes the gate voltage of Q535 drop to "L" level when the motor stops, thus assuring smooth starting of the motor.

(8) Phase compensation output amplifier circuit

1) The APC output developed at pin ⑭ of IC501 passes through the phase compensation filter smoothing circuit consisting of R518, R593, C514, and R528 and enters pin ⑫ of IC508.
2) A bias voltage determined by RS20, RS21 and RS22 is used to limit voltage at (–) side of C514 within a specified voltage range through D531, thereby preventing run away under no signal condition and improving transient response.
3) The AFC output developed at pin ⑮ of IC501 is filtered by R519 and C512, and then enters the gain switching circuit of IC505 in passing through the buffer of IC508 (pins ⑧– ⑩).

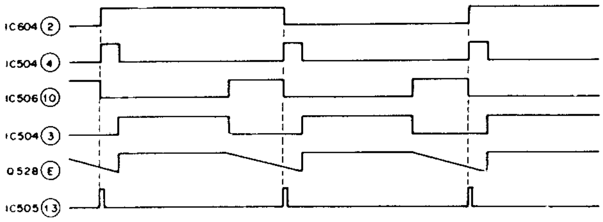


Fig. 4-5-8 AFC (EP mode) turning chart

Inside IC505 three switches are provided as shown in Table 4-5-2 and they are controlled by the gain 1 and gain 2 signals from the logic microcomputer IC601. The gain is determined by which one of resistors R567, R568, and R569 is selected as the signal path.

4) After the gain selection, the AFC signal enters pin ⑬ of RC508 and differentially amplified with the AFC signal.
5) R533 and C518 function as a filter and D512 and R534 provide a constant bias for C518 when the motor stops, thus improving starting characteristic of the motor.
6) The amplified output enters the drive transistor Q529 and the Q529 drives the capstan motor.

(9) Cue/Review

1) Cue/Review operations with fixed noise bars are realized by rotating the capstan motor in high speed and operating both APC and AFC inside the servo IC501.
2) When one of mode setting pins ⑧ – ⑩ (Cue/review, x5, or x15) of servo IC is designated, the CTL and FG signals entered the IC are counted down to 1/5 or 1/15, and the phase detection and speed detection are performed.
3) Each APC and AFC output developed at pin ⑭ and pin ⑮, respectively is used in the servo loop having the same structure as that of the play mode in the SP mode, and drives the capstan motor. In this case, the function which discriminates operation modes (EP or SP) is always actuated.

Table 4-5-2 Gain switch truth table

Mode Control signal	SP REC PLAY	C/R SP x 5 EP x 5	C/R EP x 5	EP REC PLAY	Slow
Gain 1	H	L	H	L	L
Gain 2	L	H	H	L	L

4-5-5 Tape speed discrimination/designation circuit

1) The SP, LP or EP mode is determined by combination of HIGH and LOW levels at pins ②, and ③ of IC501. (Refer to Table 4-5-3). These terminals are I/O terminals and it is possible to designate a mode externally. Both terminals are directly connected to logic microcomputer IC601 and IC501 accepts a mode command from the microcomputer when pin ④ of IC601 opens in the record mode. In the playback mode, pin ④ of IC601 goes low and the microcomputer detects HIGH and LOW signal at pins ② and ③ of IC501. The output signal at pin③is sent to the invertor consisting of NOR circuit inside IC509 and used as switching signals.

4-5-6 Synchronous editing

1) The synchronous editing operation is performed so that no picture disturbance is caused at editing portion by rotating the capstan motor in reverse direction for a specified time period at start of REC PAUSE mode, setting the servo IC to the edit mode (synchronous editing mode) and by resuming the recording after performing phase matching to the phase of CTL signal previously recorded.

Table 4-5-3

	SP	LP	EP
IC501 ②	H	L	L
IC502 ③	L	H	L

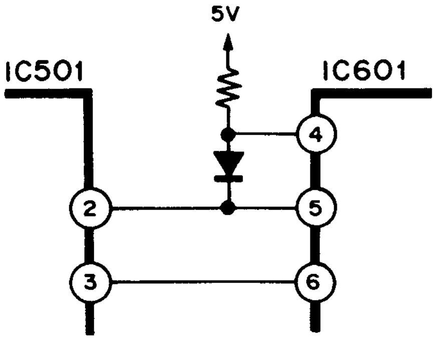
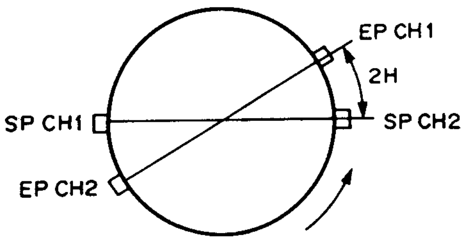


Fig. 4-5-9

4-5-7 Slow

1) The slow playback operation is achieved by repeatedly performing operations of: capstan motor start, rotating at a constant speed, speed reduction, and stop.
2) Fig. 4-5-10 shows head mounting, head width, and mounting deviation.



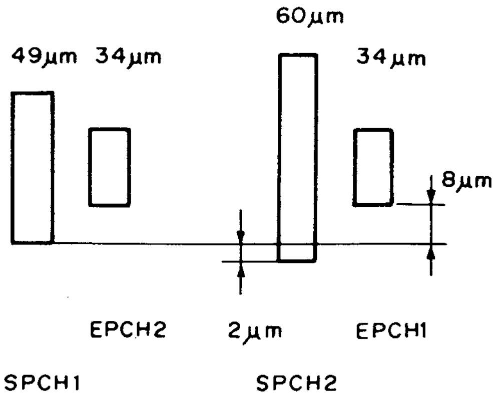


Fig. 4-5-11

3) In the SP still mode, SP-CH2 and EP-CH2 heads are used and in the EP still mode, EP-CH1 and SP-CH1 heads are used.
4) Fig. 4-5-11 shows the timing chart for the SP still mode and Fig. 4-5-12 for the EP still mode. These timings are determined by the logic microcomputer IC601. Now description will be given by referring to the timing charts.

(1) START POSITION: (period ①)

This sets timing of drive starting. RFSW pulse is sent to the microcomputer to drive the capstan by setting 3ST signal to positive rotation mode after a specified time period from falling edge of the RFSW pulse.

(2) FORCED STARTING: (period ②)

At the starting time full voltage will be applied to the capstan motor by maintaining the still-slow signal at low level.

(3) CONSTANT SPEED PERIOD: (period ③)

The slow-still signal from the logic microcomputer starts the capstan servo operation.

As both the gain 1 and the gain 2 signals are in low level, the discrete AFC circuit operates. As a result, in the EP mode the tape speed is going to the normal playback tape speed. However, the FM multiplexer of IC504 (pins ④ – ⑥) is disabled by D517, 480 Hz sampling or 2/3 times the normal playback speed is stabilized.

In this case, as a purpose of the capstan is to keep constant travel speed, a voltage determined by R523, R524, and R525 is applied to pin ⑫ of IC508 through Q531. This bias voltage has been set to 25V in the SP mode and to 1.5V in the EP mode.

(4) TRACKING:

Tape is driven and CTL pulse signal develops. The CTL pulse developed at pin ⑭ of IC507 enters pin ④ of IC506 and is subject to time delay determined by C530,and SLOWVR. The delayed pulse enters the logic microcomputer as well as triggers a brake pulse.

(5) BRAKE: (period ④)

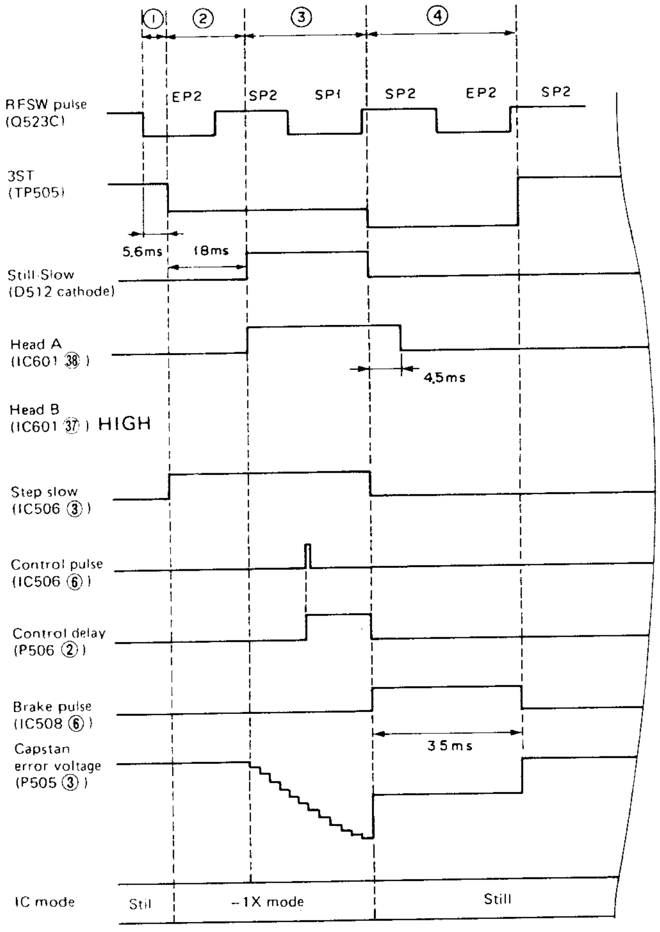
A brake signal from the microcomputer IC601 makes pin ⑥ of IC508 open. As a result, pin ⑦ of IC508 develops a voltage determined by the constant bias circuit consisting of thermistor RS32 and RS27. While pin ⑥ of IC508 goes low with no brake signal, so the diode D533 is reverse biased in this period.

(6) PICTURE H-SWING CORRECTION

This correction is performed by setting the servo IC to −1X mode and developing the slow step signal from the microcomputer for the same period and accerating the cylinder with the step signal applied through D534 and RS34 during the starting operation of the capstan and the steady state rotation.

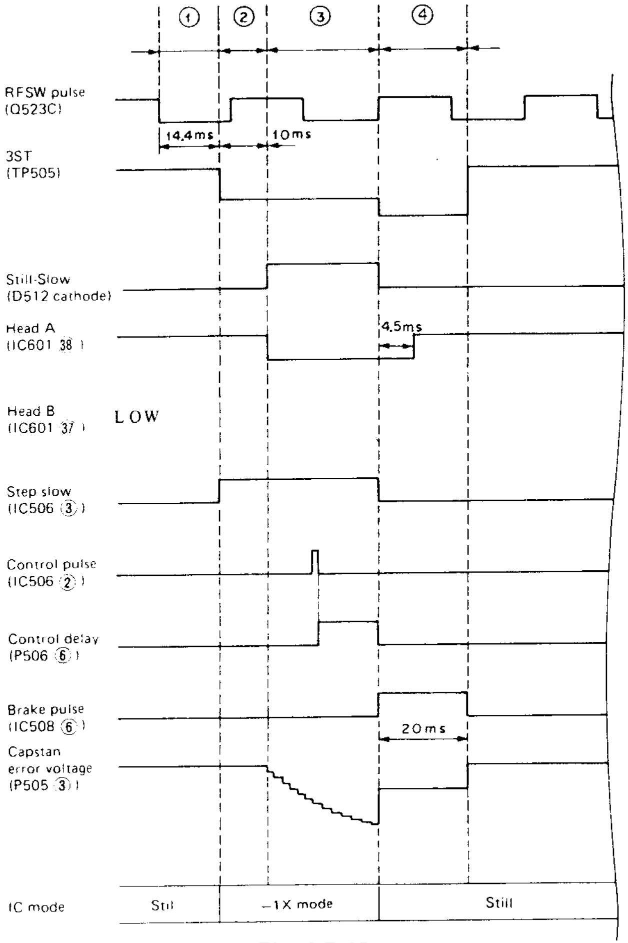
(7) HEAD SELECTION:

To obtain maximum envelope output during tape travelling, head switching is necessary. The switching timing is set by referring to a rising or falling edge of the still-slow signal.



①
②
③
④
RFSW pulse (Q523C)
EP2
SP2
SP1
SP2
EP2
SP2
3ST (TP505)
5.6ms
18ms
Still-Slow (D512 cathode)
Head A (IC601 ㊳)
4.5ms
Head B (IC601 ㊲) HIGH
Step slow (IC506 ③)
Control pulse (IC506 ⑥)
Control delay (P506 ②)
Brake pulse (IC508 ⑥)
35ms
Capstan error voltage (P505 ③)
IC mode
Stil
−1X mode
Still

Fig. 4-5-11



①
②
③
④
RFSW pulse (Q523C)
14.4ms
10ms
3ST (TP505)
Still-Slow (D512 cathode)
Head A (IC601 ㊳)
4.5ms
Head B (IC601 ㊲)
LOW
Step slow (IC506 ③)
Control pulse (IC506 ②)
Control delay (P506 ⑥)
Brake pulse (IC508 ⑥)
20ms
Capstan error voltage (P505 ③)
IC mode
Stil
−1X mode
Still

Fig. 4-5-12

4-5-8 Pseudo vertical sync signal (V pulse) circuit

1) To prevent vertical filter in special playback modes, it is necessary to insert a pseudo vertical sync signal in video signals.

   The pseudo vertical sync signal is created by processing the SW pulse with two mono stable multivibrators.

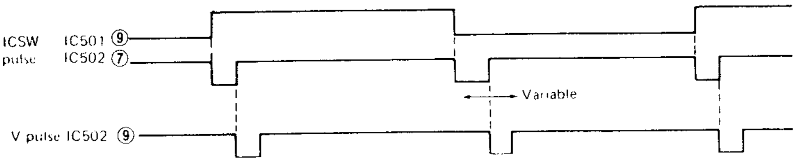
2) Fig. 4-5-13 shows the timing chart.

3) The SW pulse developed at pin ㉙ of IC501 is multiplied by IC504 (pins ⑧ − ⑩) and applied to pin ④ of IC502 where the pulse is delayed

4) The delayed time period or amount of the delay is determined by C539 and R577 (approx. 450 μsec) when the ICSW pulse is high. However, when the ICSW pulse is low, amount of delay by C543 and RS56 or RS57 is further added as Q526 turns on.

5) RS56 and RS57 are user controls (pseudo V, VR) and are used to eliminate vertical jitter on picture in the still mode.

6) The delayed signal enters pin ⑫ of IC502 and processed to develop a negative pulse equivalent to approx. 4H (V pulse) and then the signal is sent to the video circuit and mixed with video signals.



ICSW pulse
IC501 ⑨
IC502 ⑦
Variable
V pulse IC502 ⑨

Fig. 4-5-13

4-6 Video Circuits

4-6-1 Outline

1) In the video circuit, a record Y signal process IC (AN6306) and playback Y signal process IC (AN6337) are employed newly, resulting in drastic reduction of part quantity.
2) Furthermore, a head signal processing circuit, is contained in the video circuit.

4-6-2 Record circuit

(1) Luminance signal record circuit

1) The input selection switch provided inside the front panel drives the input switching IC301 on the video circuit.
   The input switching IC (IC301) selects a line input or a tuner input and supplies the picture signal to pin ③.
2) A composite picture signal entered pin ③ passes the sync AGC and the peak AGC, and outputs from pin ㉒ with its level properly adjusted. The output is split into three: the first enters the base of Q411 as a signal for color processing; the second enters pin ⑳ of IC201 as an E-E signal; and the third enters the LPF (Z202) as a record Y signal.
3) The E-E output (composite picture signal) enters IC201 and selected by the REC/PLAY switch inside the IC and outputs from pin ⑲. The pin ⑲ output enters the base of Q302 (output stage buffer) and is subject to emitter follower. The emitter follower output appears from the line output terminals.
4) At the same time, the output signal is corrected to match the NTSC group delay distortion correction curve and then sent to the RF modulator through Q304 buffer.
5) The video signal (Y) removed color components by LPF (Z202), passes buffer (Q208), and is sync-clamped at pin ⑳ of IC202, amplified, and finally outputs from pin ⑱.
6) In the SP mode, switch (Q209) closes and the Y signal passes through the buffer (Q207), is subject to sync-clamp again is pre-emphasized at pin ⑯, and then amplitude-limited in the white clip and dark clip circuits. Thus processed signal is output from pin ⑭.
7) In the EP mode, as the switch (Q209) does not close, the Y signal is subject to a non-linear emphasis before it is subject to the pre-emphasis. The non-linear emphasis is a kind of emphasis which increases amount of emphasis as signal amplitude decreases.
8) In the EP mode as record track width on a tape becomes narrower than that in the SP mode, so the S/N lowers. The non-linear emphasis prevent this S/N reduction.
9) In a FM modulation system, modulation index lowers as modulation frequency increases. As a result the S/N lower when the signals are demodulated. To prevent this, higher frequency signals are emphasized before they are subject to frequency modulation (pre-emphasis) and then reduced in their level after the demodulation (de-emphasis).
10) In the EP mode, the non-linear emphasis operation is further employed in addition to the pre-emphasis and the de-emphasis operations, thus improving more S/N in low level signals.
11) The Y signal developed at pin ⑭ passes through the deviation adjustment VR R255 and enters pin ⑫ of a current type FM modulator.
12) The pin ⑫ is also connected to the VR R254 for FM carrier frequency adjustment and the 1/2 f_H shift circuit (Q218) which works in the EP mode.
13) In a high density guard bandless recording of the VHS system, recording is performed with a slant azimuth of ± 6° to suppress crosstalk from adjacent tracks. The crosstalk will more increase in the EP mode. To eliminate this a 1/2 f_H shift circuit is actuated in the EP mode.
14) The 1/2 f_H shift is to increase the FM carrier frequency recorded with the CH1 head by 1/2 f_H from the carrier frequency recorded with the CH2 head. This shift operation is performed to remove crosstalk signals with a Y-comb filter (which will be described later) by modifying the crosstalk signal so that it has no correlation with f_H.
15) In the FM modulator, a sync tip level is deviated to 3.4MHz and a 100% white level to 4.4MHz, providing total deviation of 1 MHz. Thus modulated FM signal outputs from pin ⑪ of IC202 and enters the record YFM equalizer (Q210, Q211) with a low boost characteristic and a HPF characteristic to provide a space for insertion of a down converted color signal, and then the signal is sent to the record amplifier (IC102 for SP mode; IC103 for EP mode).
16) The switch connected to Q210 emitter in the record YFM equalizer is the over record switch and its purpose is to reduce color noises caused in synchronous editing or overlap recording and increase the YFM recording signal current until previous recording was erased by the full width erase head.
17) The record muting circuit consisting of Q108 through Q110 mutes record signals until SP or EP mode selecting operation completes and tape speed reaches steady state with the servo response stabilized. In practical, the record muting is performed by lowering the DC voltage at pin ⑪ and ⑮ of the record amplifiers IC102 and IC103, respectively.

Table 4-6-1 Video circuit

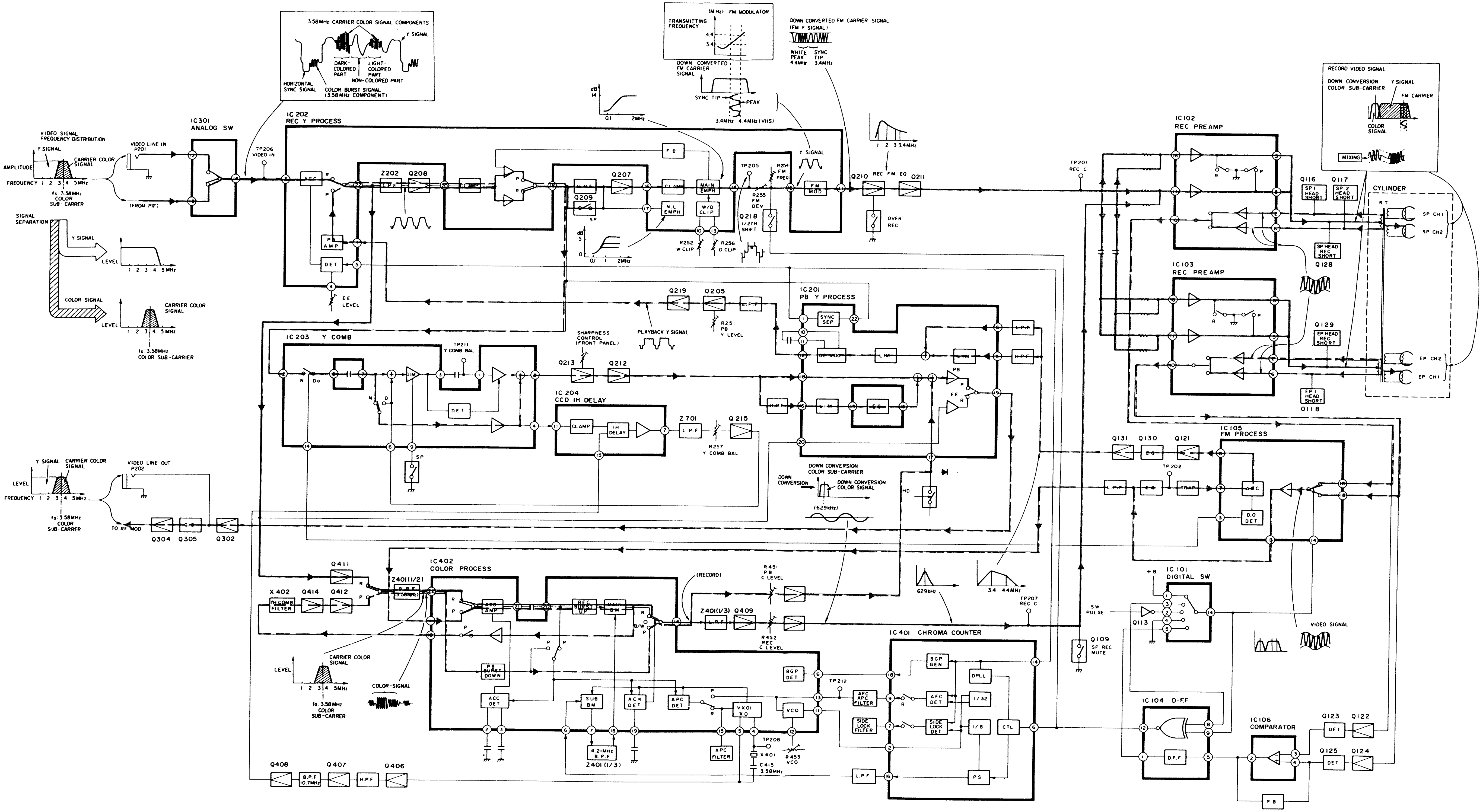
Symbol No.	IC	Operation	Function
IC101	TC4512BP (⑯pin DIP)	8ch-data selector	Head selecting signal selection
IC102 IC103	TA7772P (⑯pin DIP)	Record amp. Playback pre amp.	Rec signal amp., Low noise head amp. (pre amp), REC/PLAY switching, Channel switch
IC104	TC4013BP (⑭pin DIP)	D type flip-flop	Head switching timing control (noiseless trick mode) Color PS switching logic
IC105	TA7743P (⑱pin DIP)	Playback RF process	Head selecting SW, AGC, Drop out detection
IC201	AN6337 (㉒pin DIP)	Playback Y process	Double limitter, FM demodulator, Noise canceller, Playback Y/C mixer, Sync signal separation
IC202	AN6306 (㉒pin DIP)	Record Y process	AGC, Sync clamp, Pre-emphasis, No linear pre-emphasis, White/dark clip, FM modulator
IC203	TA7741P (⑭pin DIP)	Y-comb filter	Addition·substraction circuit, Limitter, Non-corretation detection, Dropout compensation circuit
IC204	TL8610P (⑯pin DIP)	CCD1H Delay line	Sync tip clamp 1H delay line
IC301	TC4053BP (⑯pin DIP)	By-directional analog SW	Tuner/Line in input video audio switching circuit
IC401	MN6163A (⑱pin shrink)	Digital color signal process	Color-PS ciruict, Side lock detection, Digital PLL, AFC detection circuit, Burst gape pulse generation, 1/320 division, 1/8 divition, REC/PLAY switch
IC402	AN6366NK (㉒pin shrink)	Color signal process	REC/PLAY switch, ACC, REC burst expansion, Playback burst compression, Frequency conversion I, II, 3.58 MHz OSC (XO/VXO), Color killer, VCO, APC detector
IC106	TA75393S (⑨pin SIP)	Comparator	Playback envelope level comparator

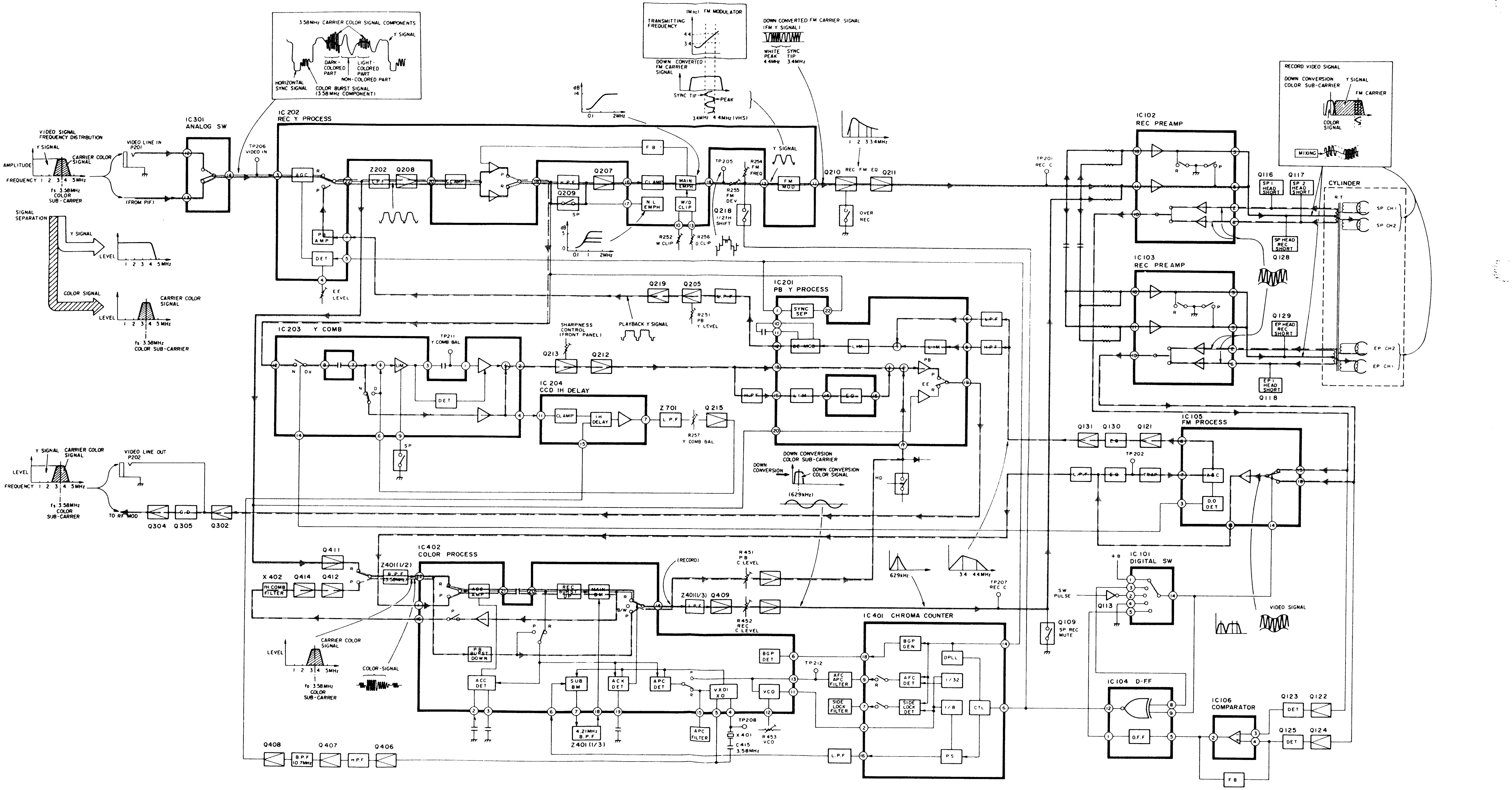
18) At the same time a down-converted color signal is added to the pin through a resistor, and a record current containing mixed Y and C signals sent from the record amplifier IC flows into the video head in passing through the rotary transformer on the cylinder.

19) Transistors Q128 and Q129 function as shorting switches to suppress crosstalk from a rotary transformer not used in the recording and short-circuit the rotary transformer when each of them is conducted.

(2) Color signal record circuit

1) The video signal passed through the AGC circuit consisting of IC202 outputs from pin ㉒ of IC202.
2) The video signal enters the REC/PLAY switch (Q411 and Q412) and is selected by the switch. The selected signal passes through BPF (Z401 1/3) (3.58MHz) and enters the ACC amplifier through pin ㉒ of IC402.
3) The ACC amplifier functions as the burst ACC which keeps the burst level at a constant level in recording and as the color ACC which controls the reference level for the burst ACC with a color signal level. The color ACC operates to increase the ACC output levels as a color signal decreases, that is, it functions to provide a relatively large color recording current even color signal level is low, thereby increasing color S/N.
4) A color signal stabilized in its level by the ACC amplifier enters pin ⑳ via pin ㉑ and is subject to burst expansion in the burst expansion circuit, and then enters the main BM (Balanced Modulator).
5) The 4.21 MHz carrier, the phase of which is inverted every one vertical period or phase-shifted, is being applied to the BM, and the color signal of 3.58 MHz is converted into signals of 4.21 MHz ± 3.58 MHz in this stage.
6) The converted color signal outputs from pin ⑭, pass LPF (Z401 1/3), record color level adjusting control VR452, buffer Q410, and only a lower frequency component of 629 kHz (= 4.21 MHz – 3.58 MHz = 40 f_H) is extracted.
7) Thus converted color signal is applied to each pin of ⑪ and ⑮ of the record amplifiers IC102 and IC103, respectively and mixed with the YFM signal through resistor networks.
8) In the EP mode, color signal level is relatively increased by modifying addition ratio to the SP mode record amplifier IC102 and to the EP mode record amplifier IC103 using the resistor network, thereby increasing the color S/N in the EP mode.
9) A composite sync signal entered pin ⑭ of IC401 becomes the HD pulse with its equivalent pulses removed.
10) The AFC detection is performed with the HD pulse and the f_H signal created by counting down 320f_H VCO output (input pin ② of IC401) to 1/320. The resultant output is used to control and to lock the VCO to 320f_H (= 5.03 MHz) precisely.
11) Thus locked VCO output is counted down to 1/8 or 40f_H (=629 kHz) and the 40f_H color carrier signal is phase-shifted by the f_H pulse stabilized in the DPLL (Digital Phase Locked Loop).
    The rotating direction of the phase shift depends upon a signal level applied to pin ⑥ of IC401. That is:
    when the color PS switching signal applied to pin ⑥ of IC401 is H level, the phase advances by 90° every 1H and L level retards by 90°.
12) Thus processed 40f_H PSSC (Phase Shifted Sub-Carrier) outputs from pin ⑯ of IC401, and enters pin ⑨ of IC402, sub-BM through the LPF which removes harmonics from the color signal.
13) The 3.58 MHz frequency locked to the color burst frequency by the record APC circuit is being applied to the sub-BM and the PSSC signal entered the sub-BM is heterodyned with the 3.58 MHz signal and converted into 3.58 MHz ± 629 KHz and outputs from pin ⑦ of IC402.
14) This output enters 4.21 MHz BPF (Z104 1/3) and only the 4.21 MHz component (3.58 MHz + 629 kHz) is extracted, and the signal is used as a carrier signal to convert a color signal to the lower frequency as previously stated.


3.58MHz CARRIER COLOR SIGNAL COMPONENTS
Y SIGNAL
DARK-COLORED PART
LIGHT-COLORED PART
NON-COLORED PART
HORIZONTAL SYNC SIGNAL
COLOR BURST SIGNAL (3.58 MHz COMPONENT)
VIDEO SIGNAL FREQUENCY DISTRIBUTION
Y SIGNAL
CARRIER COLOR SIGNAL
AMPLITUDE
FREQUENCY
fs: 3.58MHz COLOR SUB-CARRIER
SIGNAL SEPARATION
LEVEL
COLOR SIGNAL
IC301 ANALOG SW
VIDEO LINE IN P201
(FROM PIF)
TP206 VIDEO IN
IC 202 REC Y PROCESS
A.G.C
Z202
Q208
PB AMP
DET
EE LEVEL
CLAMP
Q207
Q209
SP
F B
CLAMP
MAIN EMPH
N.L EMPH
W/D CLIP
R252 W CLIP
R256 D CLIP
TP205
R254 FM FREQ
R255 FM DEV
Q218 1/2fH SHIFT
FM MOD
(MHz) FM MODULATOR
TRANSMITTING FREQUENCY
DOWN CONVERTED FM CARRIER SIGNAL
SYNC TIP
PEAK
3.4MHz 4.4MHz (VHS)
DOWN CONVERTED FM CARRIER SIGNAL (FM Y SIGNAL)
WHITE PEAK 4.4MHz
SYNC TIP 3.4MHz
Y SIGNAL
Q210
REC FM EQ
Q211
OVER REC
TP201 REC C
IC102 REC PREAMP
IC103 REC PREAMP
Q116
SP1 HEAD SHORT
Q117
SP2 HEAD SHORT
SP HEAD REC SHORT
Q128
Q129
EP HEAD REC SHORT
EP1 HEAD SHORT
Q118
CYLINDER
SP CH1
SP CH2
EP CH2
EP CH1
RECORD VIDEO SIGNAL
DOWN CONVERSION COLOR SUB-CARRIER
Y SIGNAL
FM CARRIER
COLOR SIGNAL
MIXING
Q219
Q205
R251 PB Y LEVEL
IC201 PB Y PROCESS
SYNC SEP
DE MOD
LIM
L.P.F
H.P.F
PB
EE
HD
PLAYBACK Y SIGNAL
SHARPNESS CONTROL (FRONT PANEL)
IC203 Y COMB
TP211 Y COMB BAL
DET
LIM
Q213
Q212
IC 204 CCD 1H DELAY
CLAMP
1H DELAY
Z701
L.P.F
Q215
R257 Y COMB BAL
DOWN CONVERSION COLOR SUB-CARRIER
DOWN CONVERSION
DOWN CONVERSION COLOR SIGNAL
(629kHz)
Q131
Q130
Q121
IC105 FM PROCESS
TP202
TRAP
A.G.C
D.O DET
VIDEO LINE OUT P202
TO RF MOD
Q304
Q305
Q302
Q411
X402
Q414
Q412
1H COMB FILTER
Z401(1/2)
B.P.F 3.58MHz
IC402 COLOR PROCESS
ACC AMP
REC WHITE UP
MAIN BM
PB BURST DOWN
ACC DET
SUB BM
ACK DET
APC DET
VXO1 XO
VCO
BGP DET
4.21MHz B.P.F
Z401(1/3)
APC FILTER
TP208
X401
C415 3.58MHz
R453 VCO
(RECORD)
R451 PB C LEVEL
Z401(1/3)
Q409
L.P.F
R452 REC C LEVEL
629kHz
3.4 4.4MHz
TP207 REC C
IC401 CHROMA COUNTER
BGP GEN
DPLL
AFC APC FILTER
AFC DET
1/32
SIDE LOCK FILTER
SIDE LOCK DET
1/8
CTL
PS
L.P.F
TP212
CARRIER COLOR SIGNAL
COLOR-SIGNAL
fs: 3.58MHz COLOR SUB-CARRIER
Q408
B.P.F 10.7MHz
Q407
H.P.F
Q406
+B
IC101 DIGITAL SW
SW PULSE
Q113
Q109 SP REC MUTE
VIDEO SIGNAL
IC104 D-FF
D.F.F
IC106 COMPARATOR
F B
Q123
Q122
DET
Q125
Q124
DET



3.58MHz CARRIER COLOR SIGNAL COMPONENTS
Y SIGNAL
DARK-COLORED PART
LIGHT-COLORED PART
NON-COLORED PART
HORIZONTAL SYNC SIGNAL
COLOR BURST SIGNAL (3.58MHz COMPONENT)
FM MODULATOR
TRANSMITTING FREQUENCY
DOWN CONVERTED FM CARRIER SIGNAL
SYNC TIP
PEAK
3.4MHz 4.4MHz (VHS)
DOWN CONVERTED FM CARRIER SIGNAL (FM Y SIGNAL)
WHITE PEAK 4.4MHz
SYNC TIP 3.4MHz
RECORD VIDEO SIGNAL
DOWN CONVERSION COLOR SUB-CARRIER
Y SIGNAL
FM CARRIER
COLOR SIGNAL
MIXING
VIDEO SIGNAL FREQUENCY DISTRIBUTION
AMPLITUDE
FREQUENCY 1 2 3 4 5MHz
fs 3.58MHz COLOR SUB-CARRIER
CARRIER COLOR SIGNAL
SIGNAL SEPARATION
LEVEL
COLOR SIGNAL
VIDEO LINE IN P201
(FROM PIF)
IC301 ANALOG SW
TP206 VIDEO IN
IC202 REC Y PROCESS
AGC
PB AMP
DET
EE LEVEL
Z202
Q208
L.P.F
CLAMP
H.P.F
Q209
SP
Q207
F.B
CLAMP
MAIN EMPH
N.L EMPH
W/D CLIP
R252 W CLIP
R256 D CLIP
TP205
R254 FM FREQ
R255 FM DEV
Q218 1/2fH SHIFT
FM MOD
Q210
REC FM EQ
Q211
OVER REC
TP201 REC C
IC102 REC PREAMP
Q116
Q117
SP1 HEAD SHORT
SP2 HEAD SHORT
CYLINDER
SP CH1
SP CH2
SP HEAD REC SHORT
Q128
IC103 REC PREAMP
Q129
EP HEAD REC SHORT
EP CH2
EP CH1
EP1 HEAD SHORT
Q118
Q219
Q205
L.P.F
R251 PB Y LEVEL
IC201 PB Y PROCESS
SYNC SEP
DE-MOD
LIM
L.P.F
H.P.F
EQ
SHARPNESS CONTROL (FRONT PANEL)
PLAYBACK Y SIGNAL
IC203 Y COMB
TP211 Y COMB BAL
Q213
Q212
IC204 CCD 1H DELAY
CLAMP
1H DELAY
Z701
Q215
R257 Y COMB BAL
DOWN CONVERSION COLOR SUB-CARRIER
DOWN CONVERSION
DOWN CONVERSION COLOR SIGNAL
(629kHz)
HD
Q131
Q130
Q121
IC105 FM PROCESS
TP202
TRAP
AGC
D.O DET
VIDEO LINE OUT P202
TO RF MOD
Q304
Q305
Q302
G.D
Q411
IC402 COLOR PROCESS
Z401(1/2) B.P.F 3.58MHz
X402 1H COMB FILTER
Q414
Q412
ACC AMP
REC BURST UP
MAIN BM
B/W
(RECORD)
R451 PB C LEVEL
Z401(1/3)
Q409
R452 REC C LEVEL
629kHz
3.4 4.4MHz
TP207 REC C
PB BURST DOWN
ACC DET
SUB BM
ACK DET
APC DET
VXO1 XO
VCO
APC FILTER
4.21MHz B.P.F
Z401(1/3)
TP208
X401
C415 3.58MHz
R453 VCO
BGP DET
TP212
IC401 CHROMA COUNTER
BGP GEN
AFC APC FILTER
AFC DET
DPLL
1/32
SIDE LOCK FILTER
SIDE LOCK DET
1/8
CTL
PS
L.P.F
CARRIER COLOR SIGNAL
fo 3.58MHz COLOR SUB-CARRIER
COLOR-SIGNAL
Q408
Q407
Q406
B.P.F 10.7MHz
H.P.F
+B
IC101 DIGITAL SW
SW PULSE
Q113
Q109 SP REC MUTE
VIDEO SIGNAL
IC104 D-FF
D.F.F
IC106 COMPARATOR
F.B
Q123
Q122
Q125
Q124
DET

4-6-3 Play back circuit

(1) Luminance signal play back circuit

1) Signals induced by the video heads pass the rotary transformer and enter pin ② (CH-1) and pin ⑥ (CH-2) of IC102 in the SP mode, and pin ⑥ (CH-1) and pin ② (CH-2) of IC103 in the EP mode.
2) Preamplifiers amplify these signal by approx. 60dB and then make them a continued signal of CH-1, CH-2, Ch-1, ..., connected in series by driving the SW circuits with RF-SW pulses. Thus processed signal is output from pin ⑩ .
3) Transistors Q114, Q116, Q117, Q118 and Q120 are used to short-circuit windings of the rotary transformer not used in a normal play back or special play back modes to reduce crosstalk caused by outputs from heads not used.
4) The SP heads or EH heads output signals developed at each pin ⑩ of IC102 and IC103 are applied to pins ⑮ and ⑱ of IC105 and selected by a head selection signal (SP heads: L, EP heads: H) applied to pin ⑭. The selected signal is amplified by approx. 13dB and outputs from pin ⑬ .
5) The play back RF signal output from pin ⑬ enters a color signal playback circuit. At the same time the signal passes through the equalizer circuit and becomes a play back envelope output (TP202). The luminance signal with the down converted color signal component removed with a trap enters the AGC circuit through pin ⑦ of IC105 again.
6) The play back RF signal, amplitude of which is adjusted to a constant value of 0.4Vpp by the AGC circuit, enters the buffer amplifier Q121 through pin ⑥, and then enters the FM phase equalizer consisting of Q130 and Q131.
7) The purpose of the FM phase equalizer is to compensate the phase distortion caused by lower frequency emphasized recording or frequency response compensation of the Y-FM carrier frequency.
8) On the other hand, the playback YFM signal outputs from pin ⑥ of IC105. At the same time enters the drop out circuit (DO DET) inside the IC and the IC develops a drop out detection pulse (DOP) as the amplitude drops to a level disabling the AGC action.
9) The drop out detection pulse enters pin ⑭ of IC203 and triggers the drop out compensation circuit using a CCD 1H delay line.
10) The YFM signal phase-compensated by Q130 & Q131 and passes through LPF and HPF consisting of R201, C214, R202, C215, L210, R203, and its lower and higher frequency components are separated each other. Then each of them enters pins ⑤ and ⑥ of IC201, passes through the double limiter circuit inside the IC, and enters the FM demodulator.
11) The FM demodulator consists of a nonstable multivibrator and a multiplier and the output developed at pin ⑫ becomes a demodulated output in passing through a low pass filter (R212, C207, L201, C208, R208, C201).
12) The YFM signal demodulated is subject to play back level adjustment (R251) and de-emphasis (R206, C203, R207), then enters pin ① of IC202 via Q219.
13) The play back YFM signal amplified by approx. 12 dB inside IC202 and developed at pin ㉒ enters the LPF (Z202) again to eliminate high frequency noise components further. At the same time the YFM signal is subject to phase matching to the color signal and then enters the clamp input, pin ⑳ of IC202 through buffer amplifier Q208.
14) The signal is clamped and then, in the EP mode, is subject to the non-linear de-emphasis because the non-linear emphasis circuit is switched to feedback loop.
15) The signal restored to the same signal as the Y signal in recording at pin ⑱ next enters pin ⑫ of IC203 which constitutes a Y comb filter and a drop out compensation circuit, and goes through coupling capacitors connected to pins ⑧ and ⑦.
16) On the other hand, a signal delayed by 1H (63.56 μsec) from a real time play back signal developed at the CCD 1H delay line IC204 is being applied to pin ⑥ , and this is switched in or replaced with the output at pin ⑦ by the drop out detection pulse (pin ⑭ of IC203) stated previously when a drop out occurs.
17) When no drop out occurs, a difference signal between the inputs at pins ⑦ and ⑥ is applied to the limiter and non-correlation detection is performed. When there is no line correlation, the difference signal limits the limiter amplifier (input pin ①).
18) For signals with line correlation, a difference signal (noise) is subtracted from the real time playback signal and in the EP mode processed by the Y-comb filter.
19) IC204 is a CCD for 1H delay (63.556μsec). A playback Y signal is sent from pin ④ of IC203 and connected to pin ⑪ through a clamp capacitor C270.
20) The clamped playback Y signal passes through the charge coupled device (CCD), which is driven by 10.7 MHz clock signal created in the 3.58 MHz tripler circuit (Q406, Q407, Z403, Q408), for approx. 63μsec and outputs from pin ⑦ in passing through the sample and hold circuit.
21) The signal at pin ⑦ passes the LPF (Z201) having both functions to remove the clock signal components contained and to perform 1H time matching, is subject to a level adjustment (R257: Y-comb balance), and then enters pin ⑥ of IC203 stated previously.

22) The Y play back signal passed the Y-comb filter and the drop out compensation circuit develops at pin ② of IC203 and passes the sharpness control circuit consisting of Q213 and Q212 and enters the noise canceller circuit through pins ⑱ and ⑯ of IC201.

23) The collector of Q213 is connected to the sharpness control, thus allowing users to control sharpness as they like.

24) Only the high frequency components contained in the play back Y signal entered pin ⑱ of IC201 are extracted by the HPF (C210, R215, R214), applied to pin ⑯, limited inside the IC, and output from pin ⑭ where the signals are subject to frequency compensation. Thus processed signal enters pin ⑮ of IC201 again and is subtracted from the input applied to pin ⑱ stated previously, thus cancelling undesirable noises.

25) The playback Y signal with high frequency noises reduced in this way is mixed with the playback color signal entered pin ⑰ and becomes a composite signal of 2Vpp. The composite signal is sent to the buffer amplifier (Q302) through pin ⑲.

26) Circuits following this stage are the same as those used in the record mode, so the description will be omitted.

(2) Color signal play back circuit

1) The down converted color signal of 629 kHz is separated from the play back RF signal developed at pin ⑬ of IC105 and applied to the ACC amplifier from pin ① of IC402. The 629kHz color signal stabilized by the ACC amplifier outputs from pin ㉑ of IC402 and enters the main BM through pin ⑳ of IC401. Inside the IC402 the color signal is heterodyned with 4.21 MHz phase-shifted carrier signal being applied to the IC402 and converted into 4.21 MHz ± 629 kHz signals.

2) In this case, phase of 4.21 MHz has been adjusted by the APC loop so that it can cancel jitter components resulting from rotating parts in the mechanism section. Thus the jitter components in the frequency-converted color signal developed at pin ⑯ are suppressed.

3) The 1H comb filter (X401) functions to remove crosstalk components caused by signals on adjacent tracks from the color signal developed at pin ⑯. The color signal with the crosstalk components removed in this way passes the REC/PALY switch consisting of Q411, Q412 and Q414 and is amplified.
The amplified output passes through the BPF (Z401 1/3:3.58 MHz) and enters pin ㉒ of IC402 and outputs from pin ⑭. The output at pin ⑭ is normally superimposed with a bias voltage of approx. 2V. But the DC component becomes zero when the color killer circuit functions.

4) The playback color signal developed at pin ⑭ and adjusted in its level passes Q403 buffer and enters the Y/C MIX circuit through Q403 buffer, and mixed with the playback Y signal again and outputs from pin ⑲.

5) In the play back mode the color sync circuit functions as follow:

6) A composite sync signal separated from the playback Y signal develops at pin ① of IC201 and enters pin ⑭ of IC401. A burst signal is created by this signal and outputs from pin ⑱ and enters pin ⑥ of IC401. A burst section of the playback color signal is extracted by this burst pulse and compared with the 3.58 MHz reference signal. The resultant error signal is used to control the 320fH VCO so that it is locked at the specified frequency.

7) In this case, as the burst gate synchronizes with every one horizontal sync period, APC's stabilizing point exists at every fH period and there is a possibility for the VCO frequency to be locked at a frequency other than the 320fH.
To prevent this, a HD signal created from the composite signal entered pin ⑭ of IC402 and a VCO output entered from pin ② are compared in their frequencies, and when the VCO frequency is locked at a frequency other than the 320fH, a side lock detection pulse develops from pin ⑦ and functions to pull in the frequency to the 320fH.

8) The 320fH VCO output is counted down to 1/8 or to 40fH in the same way as in the record mode and then subjected to the specified phase shift. The 40fH signal is used to create the 4.21 MHz carrier in the sub-BM with 3.58 MHz reference signal.

9) The 4.21 MHz carrier signal and the 629 kHz color signal are applied to the main BM and a 3.58 MHz color signal is developed. In this case, amount of phase shift and rotating direction of the phases for both the 629 kHz color signal and the 4.21 MHz carrier signal are same, so the 3.58 MHz color signal is restored with undesirable phase components cancelled each other.

10) On the other hand, crosstalk components from the adjacent tracks are demodulated with phases rotating in reverse direction. As a result, the phase rotation of the crosstalk of the 3.58 MHz becomes twice 90° every 1H or 180°. That is the phase is inverted and can be removed by a 1H comb filter.

(3) Special playback mode

1 Video heads used for each mode

1) Special playback operations are performed by properly selecting a combination of heads from the four double azimuth heads employed.

2) To perform special playback operations (other than a picture search in the SP mode) head A and head B signals sent from the logic microcomputer control the data selector IC101. In the SP mode a noiseless trick signal also controls the data selector to perform the special playback operation.

3) Table 4-6-2 indicates special playback modes using the head A and head B signals, and Table 4-6-3 shows heads used for each mode of operation.

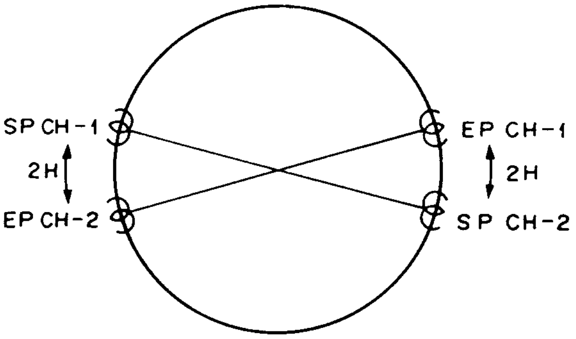


Fig. 4-6-3

4) As can be seen from the Tables, the head A signal controls the combination of the SPCH-2 and EPCH-1 heads and the head B signal controls the SPCH-1 and EPCH-2 heads. The head A and B signals give commands to IC101 to select heads to be used as well as to actuate the head short circuit as stated previously to eliminate crosstalks from the heads not used.

5) Next, description will be made on the head selection signals provided by IC101.

6) Five data are entered in IC101 and one of them is selected by three control input signals and applied to pin ⑭ as a head selection signal.

7) The three control inputs are the head A, head B, and the noiseless trick signals stated previously. Table 4-6-4 summerizes signals obtained at pin ⑭ of IC101 for each mode.

8) Here, RF SW.P means the SW pulse corresponding to the cylinder PG pulse sent from the servo circuit through pin ⑤ of W402, and shows L level for a period equivalent to 180° where the combination heads of SPCH-1 and EPCH-2 contact with a video tape and H level for another 180° where the heads do not contact with the tape.

9) Strictly speaking, the noiseless trick signal also plays another role during playback operation in the SP mode to suppress noise bands caused when the heads pass away tracks by providing H level for a transitional time period required for each mode of operation.

Table 4-6-2

Mode	Operation	Head A	Head B
SP	PB/REC	H	H
	STILL	H	L
	SLOW	H	L/H
	SEARCH	(H)	(H)
EP	PB/REC	L	L
	STILL	L	H
	SLOW	L	H/L
	SEARCH	(L)	(L)

Table 4-6-3

Mode	Operation	Heads used	
SP	PB/REC	SP CH-1	SP CH-2
	STILL· Double speed	SP CH-2	EP CH-2
	SLOW	SP CH-2	EP CH-2 SP CH-1
	SEARCH	EP CH-1 EP CH-2	SP CH-2 EP CH-1
EP	PB/REC	DP CH-1	EP CH-2
	STILL· Double speed	EP CH-1	SP CH-1
	SLOW	EP CH-1	SP CH-1 EP CH-2
	SEARCH	EP CH-1	EP CH-2

Table 4-6-4

Mode	Operation	Head selection signal
SP	PB	L
	STILL	RF SW. P
	SLOW	L/RF SW. P
	SEARCH	Envelope detection signal
EP	PB	H
	STILL	RF SW. P
	SLOW	H/RF SW. P
	SEARCH	H

2 Picture search in SP mode

1) The picture searching operation in the SP mode is performed by selecting one of four heads (SPCH-1, EPCH-2, SPCH-2 and EPCH-1) which develops a maximum output, thus realizing the picture searching with less noises.
2) By referring to the illustration below description will be given on the picture searching operation.
3) Fig. 4-6-4a and 4-6-4b show waveforms at pin ⑩ of IC102 (SP head preamplifier playback output) and pin ⑩ of IC103 (EP head preamplifier playback output). Impedance of these signals are transformed by the buffer amplifiers Q122 and Q124, and then the signals are detected in their envelopes (c & d) in the circuit consisting of Q123, Q125 and D108, and led to pins ③ and ④ of IC106, comparator.
4) In the comparator, the voltage amplitudes are compared and when the SP head output (pin ③) is higher the EP head output the comparator develops L level signal, and when the EP head output (pin ④) is higher the comparator develops H level output. These signals are used as the head selection signals. However, direct using of the signals may cause switching noises on the screen. To prevent this, switching operation is performed during the horizontal blanking period. That is, the switching operation is performed in synchronization with the horizontal sync signal by using a D flip-flop of IC104.
5) Thus processed head selection signal develops at pin ① of IC104 and enters pin ⑤ of IC101.
6) The envelope detection signal becomes the head selection signal as previously described and always selects the head which provides maximum output.
7) The picture signals selected in this way are connected in series, thus realizing the picture search with less noises.

3 Pseudo sync signal generation circuit

1) This circuit consisting of Q224, Q223 and D206 develops pseudo pulses in special playback modes from the V pulse (pin ① of W402) and the V phase signal (pin ② of W401) sent from the servo circuit and superimposed with playback color signals.
2) Pin ⑰ of IC201 has a function to mix both the playback color signal and the playback Y signal and a synchronization insertion function. With these functions special playback operations with less vertical jitter can be achieved for a tape even recorded with record phase deviated (soft tape, etc.).

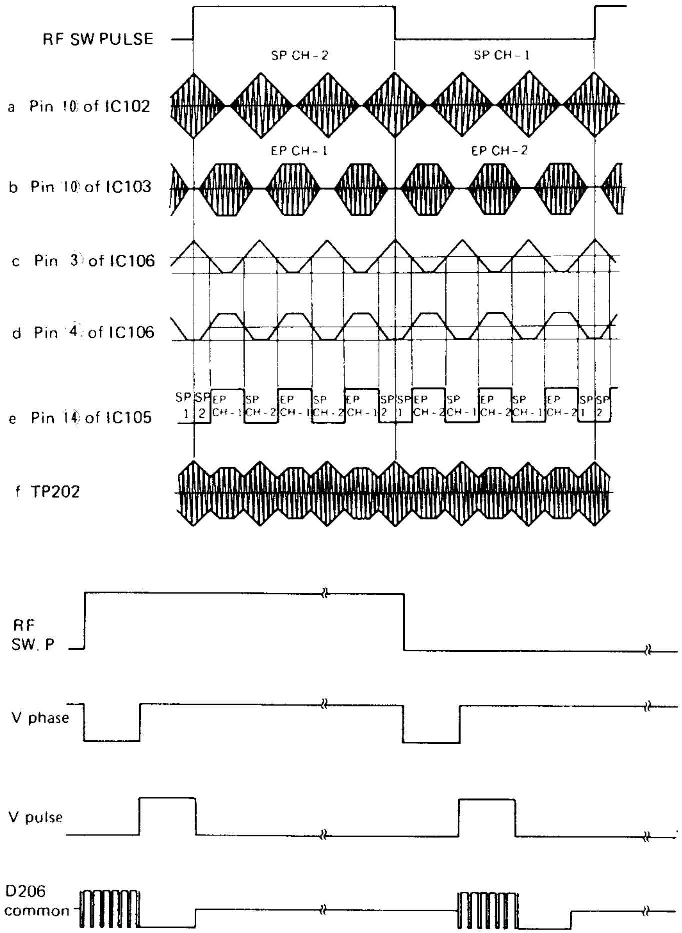


Fig. 4-6-5

4-7 Audio Circuits

4-7-1 Outline

1) The audio circuit is mounted on the video/audio PC board and employs a monaural system.
2) Major blocks in the audio circuit are the Audio 1 chip IC (ALC, line-up, record amplifiers, equalizer amplifier, muting circuit, etc.) which is newly employed this time, erase oscillator circuit, electronic switch, etc.

4-7-2 EE mode circuit description

(1) Input signal switching (P704)

1) Input signal switching is performed by the switch on the front panel.
2) IC301 on the video PC board switches the tuner input and the line input.
3) The line input nominal level is −10 dBs (245mV-rms).

(2) Record & play back switching circuit and muting circuit (IC701)

1) The record & play back switching circuit and the muting circuit are provided inside IC701.
2) The record & play back switching circuit becomes a play back mode when PB+B (HIGH) is applied to pin ㉑ of IC701 and becomes EE or record mode when LOW level voltage is applied.
3) The muting circuit mutes playback signal or record signal when HIGH level signal is applied to pin ⑳ of IC701. (The muting circuit does not work for the EE system.)

(3) Output amplifier (IC701)

1) The signal entered pin ⑪ of IC701 is amplified by approx. 35 dB and outputs from pin ⑬. The output is attenuated to a specified level and applied to the video PC board with its DC component removed. Then the output is applied to the line output terminals as well as to the RF modulator in passing through the pre-emphasis circuit.
2) The nominal output level is −7 dBs (350 mVrms).

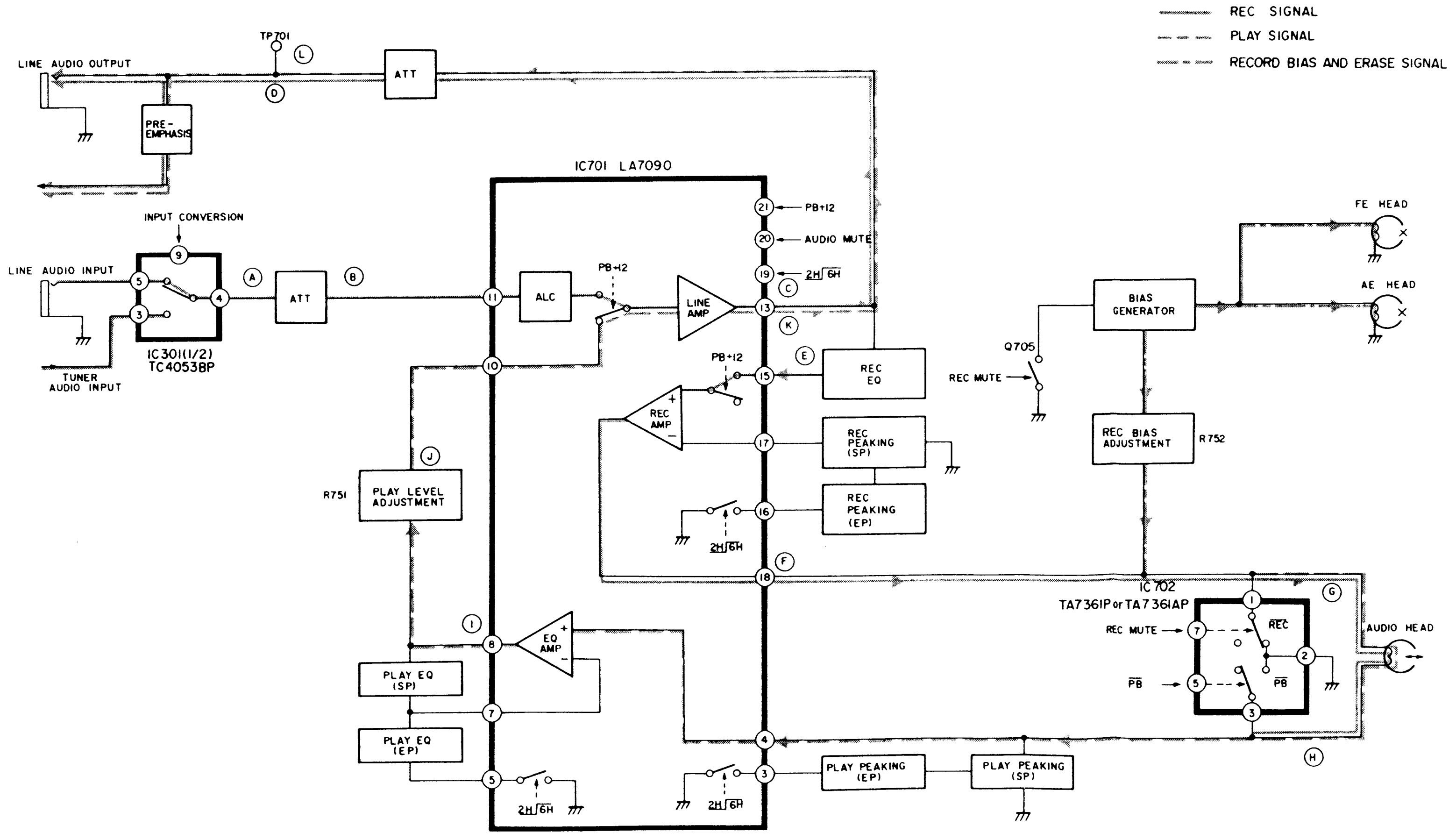
(4) ALC circuit (IC701)

1) The ALC circuit is also contained inside the IC701.
2) The signal entered pin ⑪ of IC701 is amplified by approx. 35 dB and outputs from pin ⑬.
3) When the output at pin ⑬ exceeds −4.5 dBs , a detector circuit inside the IC automatically functions and adjusts the line amplifier input level to an optimum level. As a result, the output level is automatically adjusted so that the audio head does not cause any distortion if a signal higher than the reference input level is applied.
4) The ALC operates only in record mode in the EE mode.

4-7-3 Record circuit

(1) Record amplifier circuit (IC701)

1) The signal developed at pin ⑬ of IC701 enters pin 15 in passing through the record equalizer consisting of R712, R713, R726, C724. The equalizer attenuates signals lower than 1 kHz by approx. 1 dB and prevents frequency peak over mid to high frequency range.
2) The signal applied to pin ⑮ is amplified by approx. 11 dB (400 Hz) in the record amplifier, outputs from pin ⑱ , and enters the audio head through the constant current resistor (R716).
3) Pin ⑰ functions as a negative feedback terminal for the record amplifier. A high frequency peaking circuit is connected to this feedback terminal to vary the amplifier's frequency response corresponding to the tape speed.



4) In the SP mode, the peaking circuit consists of L701, and C713 and the peaking level increases by approx. 10 dB at around 13 kHz.
5) In the EP mode, the peaking circuit consists of L701, C713, and C714 as pin ⑯ is connected, and the peaking level increases by approx. 12 dB at around 7 kHz.

(2) Erase oscillator circuit (Q704, Q705, T701)

1) The oscillator circuit consisting of Q704 and T701 is controlled by Q705 and oscillates frequency of approx. 65 kHz
The oscillator signal is used as the erasing current in the full with erase head and the audio erase head as well as a record bias for recording of audio signals.

(3) Audio head switching circuit (IC702)

1) IC702 grounds its pins ③ and ① when a voltage is applied to pins ⑤ and ⑦ , respectively. In the EE and record modes pin ③ grounds the playback terminal of the audio head through a fine resistance and opens only in the playback mode, thus allowing the playback signal to enter pin ④ of IC701.
2) Pin ① opens only in the record mode thus allowing record signals and bias signal to flow to the audio head.
3) In the playback mode, the record signal terminal of the audio head is grounded.

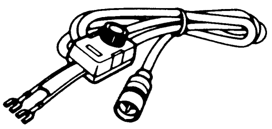
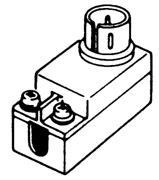
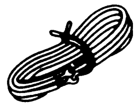
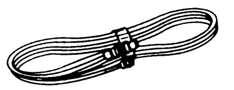
4-7-4 Playback circuit

(1) Play back amplifier (IC701)

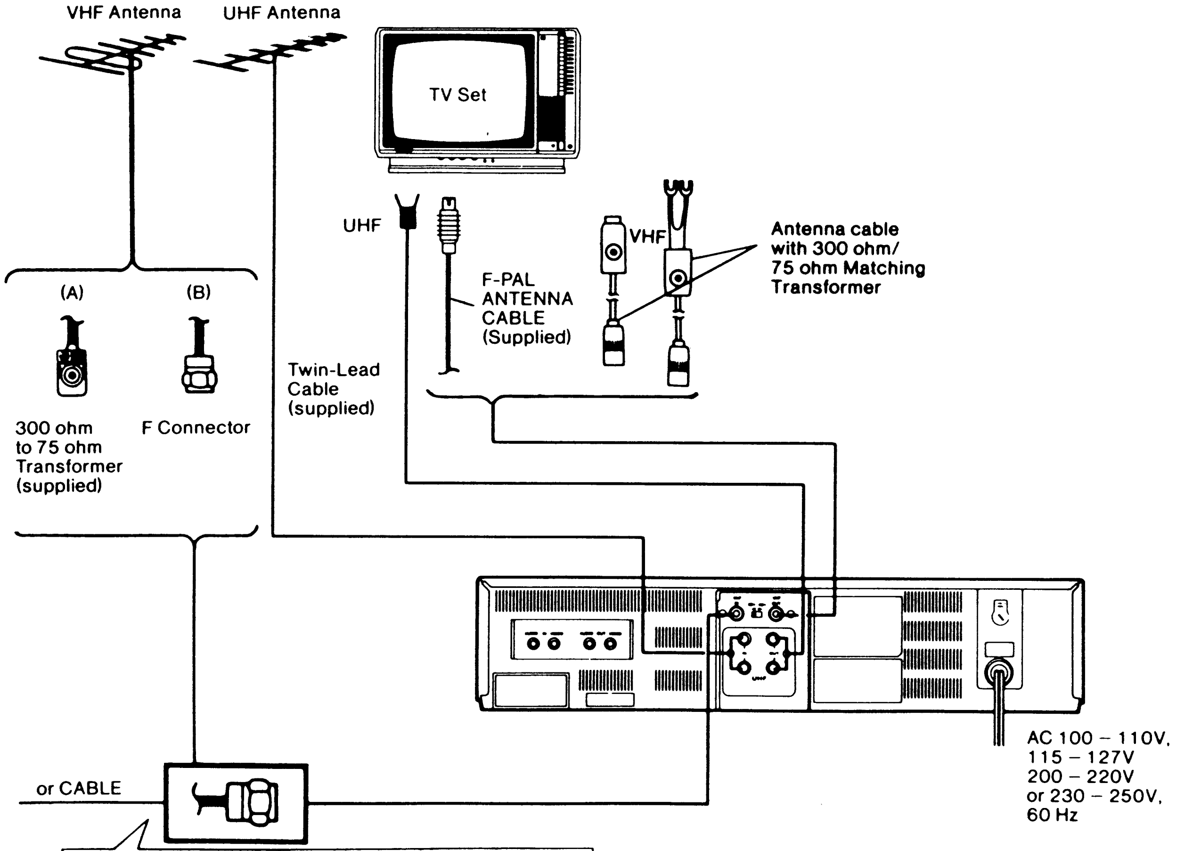
1) A play back signal induced on the audio head is first adjusted in its frequency response in the peaking circuit consisting of the head and C702 and then applied to pin ④ of IC701. The IC704 amplifies the signal by approx. 48 dB at 400 Hz and feeds the output to pin ⑧.
2) Pin ⑦ of IC701 functions as a feedback terminal and adjusts the frequency response with the impedance connected between pin ⑦ and pin ⑧. That is, an equalizing response showing a descending response from a low end (approx. 50 Hz) to mid range (approx. 1.3 kHz in SP mode) and a flat response over a higher frequency range is provided.
3) Furthermore, in the EP mode, pin ③ is grounded to shift the peaking frequency to approx. 6 kHz. Pin ⑤ is also grounded and this reduces amount of negative feedback in the mid range, thus compensating the frequency response.
4) The signal processed in this way enters pin ⑩ in passing through the playback level adjusting control (Q751), selected by the switch, amplified, and then applied to the output terminals as described in (2) and (3) in the EE mode circuit description.

5. APPENDIX

ANTENNA CONNECTION

① ANTENNA CABLE WITH 300 ohm/ 75 ohm MATCHING TRANSFORMER 	② 300 ohm/75 ohm MATCHING TRANSFORMER 	③ 300 ohm TWIN-LEAD CABLE 	④ F-PAL ANTENNA CABLE 

1. Remove the Antenna Cable from the TV set. Connect it to the "VHF IN", "UHF IN" Terminal of the VCR.
2. Connect one end of the Antenna Cable and Twin-lead cable to the "VHF OUT", "UHF OUT" Terminal of the VCR.
3. Connect the other end to the "VHF", "UHF" Terminal of the TV.


VHF Antenna
UHF Antenna
TV Set
UHF
F-PAL ANTENNA CABLE (Supplied)
VHF
Antenna cable with 300 ohm/ 75 ohm Matching Transformer
(A)
(B)
300 ohm to 75 ohm Transformer (supplied)
F Connector
Twin-Lead Cable (supplied)
or CABLE
AC 100 – 110V, 115 – 127V 200 – 220V or 230 – 250V, 60 Hz

- The unit is designed to tune the Mid-Band and Super-Band frequencies used by many cable sections.

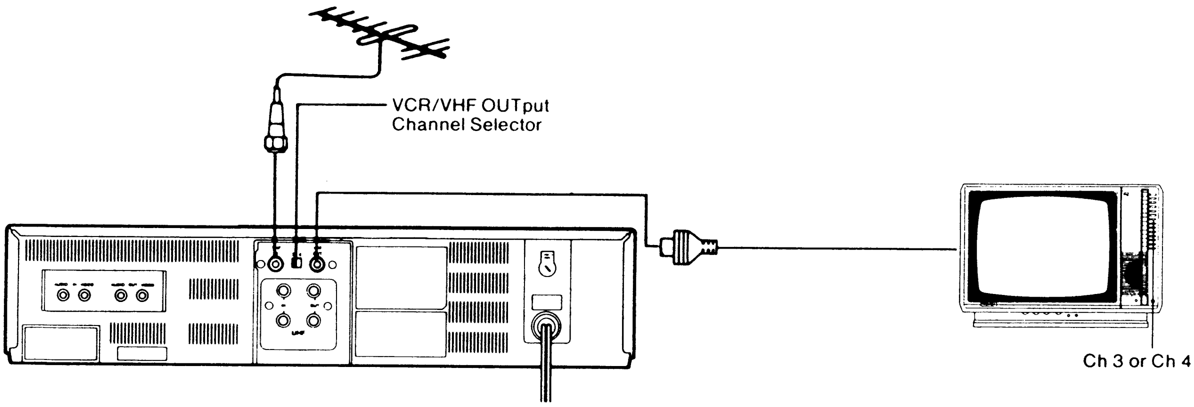
NOTE TO CATV SYSTEM INSTALLER:

The reminder is provided to call the CATV system installer's attention to Article 820-22 of the NEC that provides guidelines for proper grounding and, in particular specifies that the cable ground shall be connected to the grounding system of the building, as close to the point of cable entry as practical.

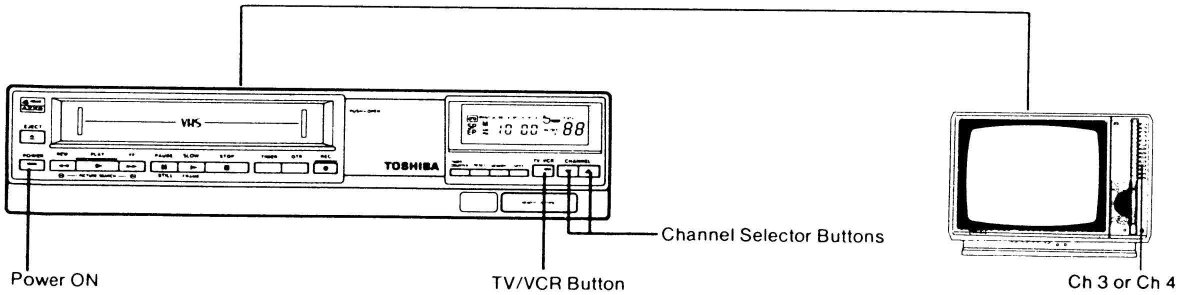
In the above configuration, you can record programs from CATV channels as well as VHF channels 2 through 13. You can record programs from 117 CATV channels except scrambled channels.

SET YOUR TELEVISION TO THE VCR CHANNEL

1. Set your TV to channel 3 unless channel 3 is one of the TV stations in your area. If channel 3 is used in your area, set your TV to channel 4 and slide the VCR/VHF OUTput Channel Selector toward channel 4. The VCR/VHF OUTput Channel Selector is located on the rear panel at upper side of the antenna connector. This is the VCR channel on your television set. Your television receiver must be tuned to this channel any time a video cassette is played back on the VCR.



2. Plug the VCR power cord into a 100–110V, 115–127V, 200–220V or 230–250V electrical outlet and press the "**POWER**" lamp will light. The clock will flash repeatedly. This is not a malfunction (see page 7).
3. Press the "**TV/VCR**" button. The VCR lamp will light. Select an active TV channel by pushing the VCR Channel Selector Buttons. The picture from that channel should now be displayed on your television.



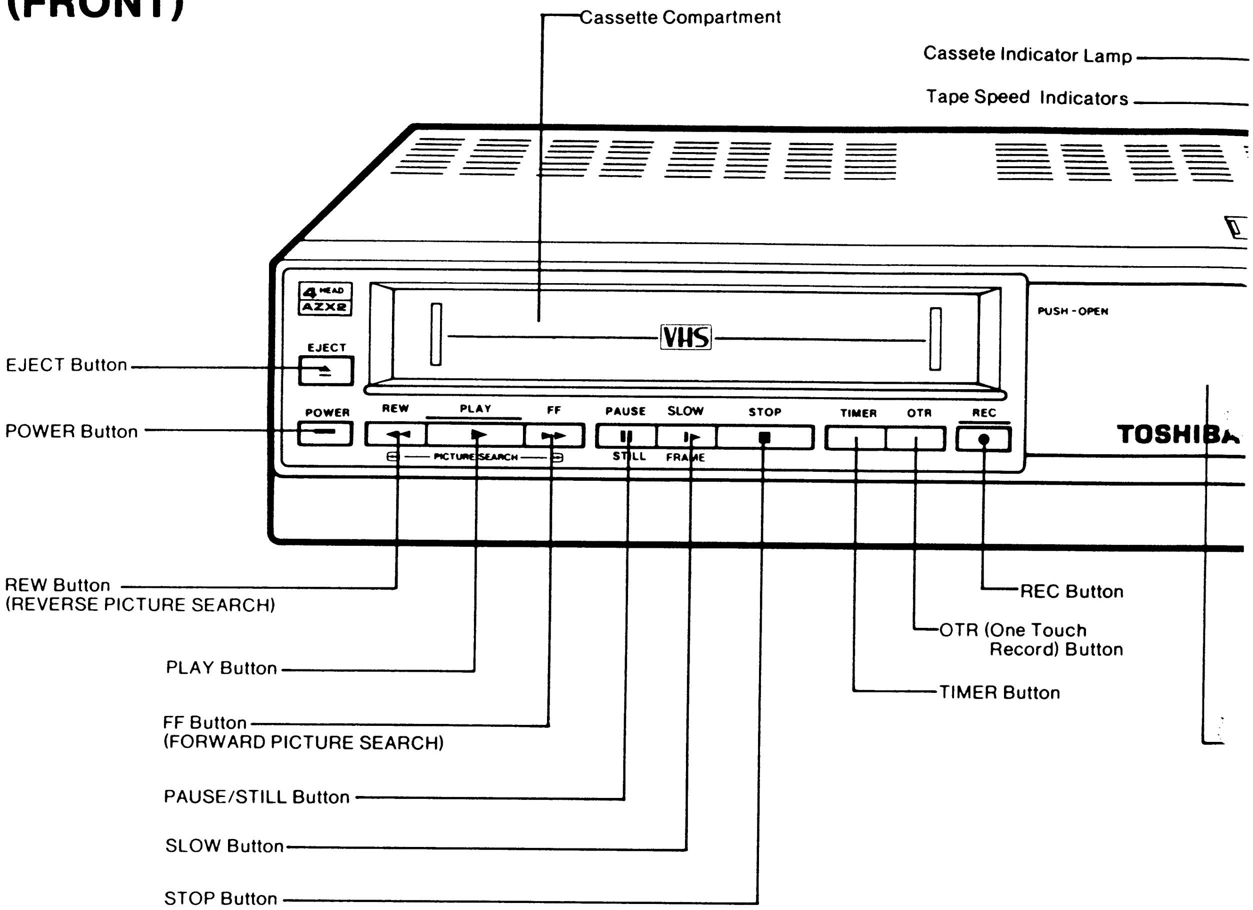
NORMAL TV VIEWING

1. Turn ON your TV receiver. There is no need to turn the POWER switch of VCR ON.
2. Tune your TV receiver to the channel you want to watch.

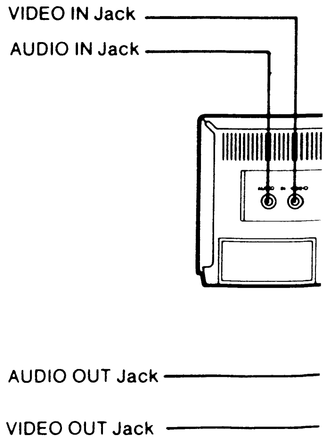
* The TV/VCR button should be set to TV position (The VCR Indicator lamp goes OFF.) if the POWER button is turned ON.

IDENTIFICATION OF CONTROLS

(FRONT)


Cassette Compartment
Cassete Indicator Lamp
Tape Speed Indicators
VHS
PUSH-OPEN
EJECT
POWER
REW
PLAY
FF
PAUSE
SLOW
STOP
TIMER
OTR
REC
PICTURE SEARCH
STILL
FRAME
TOSHIB
EJECT Button
POWER Button
REW Button
(REVERSE PICTURE SEARCH)
PLAY Button
FF Button
(FORWARD PICTURE SEARCH)
PAUSE/STILL Button
SLOW Button
STOP Button
REC Button
OTR (One Touch
Record) Button
TIMER Button

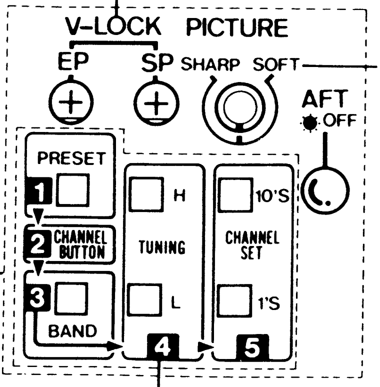
(REAR)


VIDEO IN Jack
AUDIO IN Jack
AUDIO OUT Jack
VIDEO OUT Jack

CAUTION

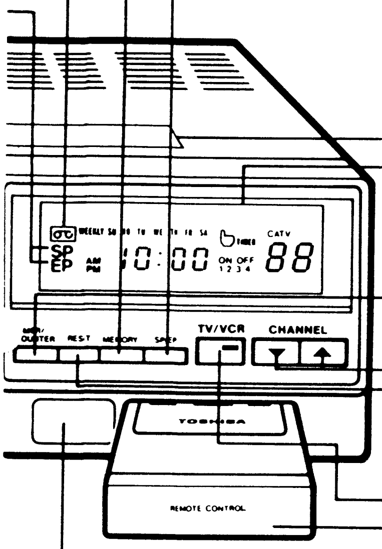
**Never operate the machine right after having transported it from a cold location directly to a warm location.
Wait for about two hours.
This is because, in such a case, moisture may condense on the head cylinder inside the machine.
The tape will tend to stick to the head cylinder and will be damaged.**

If the picture blurs during STILL, use this control to make adjustment.


V-LOCK PICTURE
EP
SP
SHARP
SOFT
AFT
OFF
PRESET
1
2 CHANNEL BUTTON
3
BAND
H
TUNING
L
10'S
CHANNEL SET
1'S
4
5

Picture sharpness controls sharper or softer pictures according to your preference.

Ch Preset Section


SP
EP
WEEKLY
10:00
ON OFF
1 2 3 4
88
CATV
TV/VCR
CHANNEL
RESET
MEMORY
SPEED
TOSHIBA
REMOTE CONTROL

Memory Button

Tape Speed Selector Button

MODE/TIMER/ COUNTER Display

TIMER/COUNTER Button
Used to change the clock display and the counter display.

Channel selector buttons

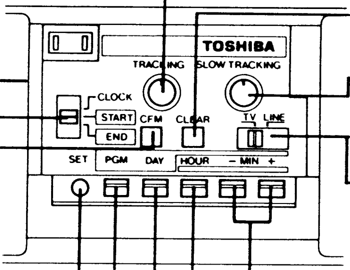
RESET Button
Used to set the tape counter to the "0000" position in counter display.

TV/VCR Button

Compartment for remote control storage

Infrared Remote Control Receiver

Behind the Door


TOSHIBA
TRACKING
SLOW TRACKING
CLOCK
START
END
CFM
CLEAR
TV LINE
SET
PGM
DAY
HOUR
– MIN +

TRACKING Control Knob
When noise stripes occur on the playback picture, turn this knob to the right or left to minimize the noise.

CLEAR Button

SLOW TRACKING Control Knob
When noise stripes occur on the slow playback picture, turn this knob to the right or left to minimize the noise.

TIMER SELECTOR (CLOCK, START, END) Switch

"CFM" Confirm Button

INPUT SELECT Switch

"SET" Button

MIN (–)/(+) Button

"HOUR" Button

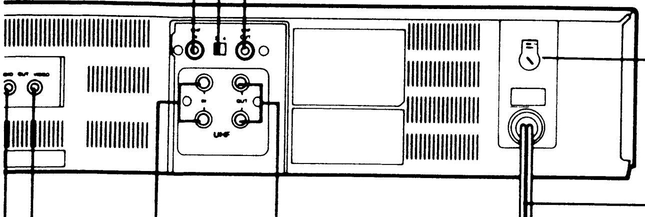
"DAY" Button

"PGM" Button

VHF IN Terminal

VCR/VHF OUTput Channel Selector

VHF OUT Terminal



Voltage Select Switch
Select AC line 100–110V, 115–127V 200–220V or 230–250V. This VCR is preset at the factory for used of the 230–250V AC line.

Power Cord

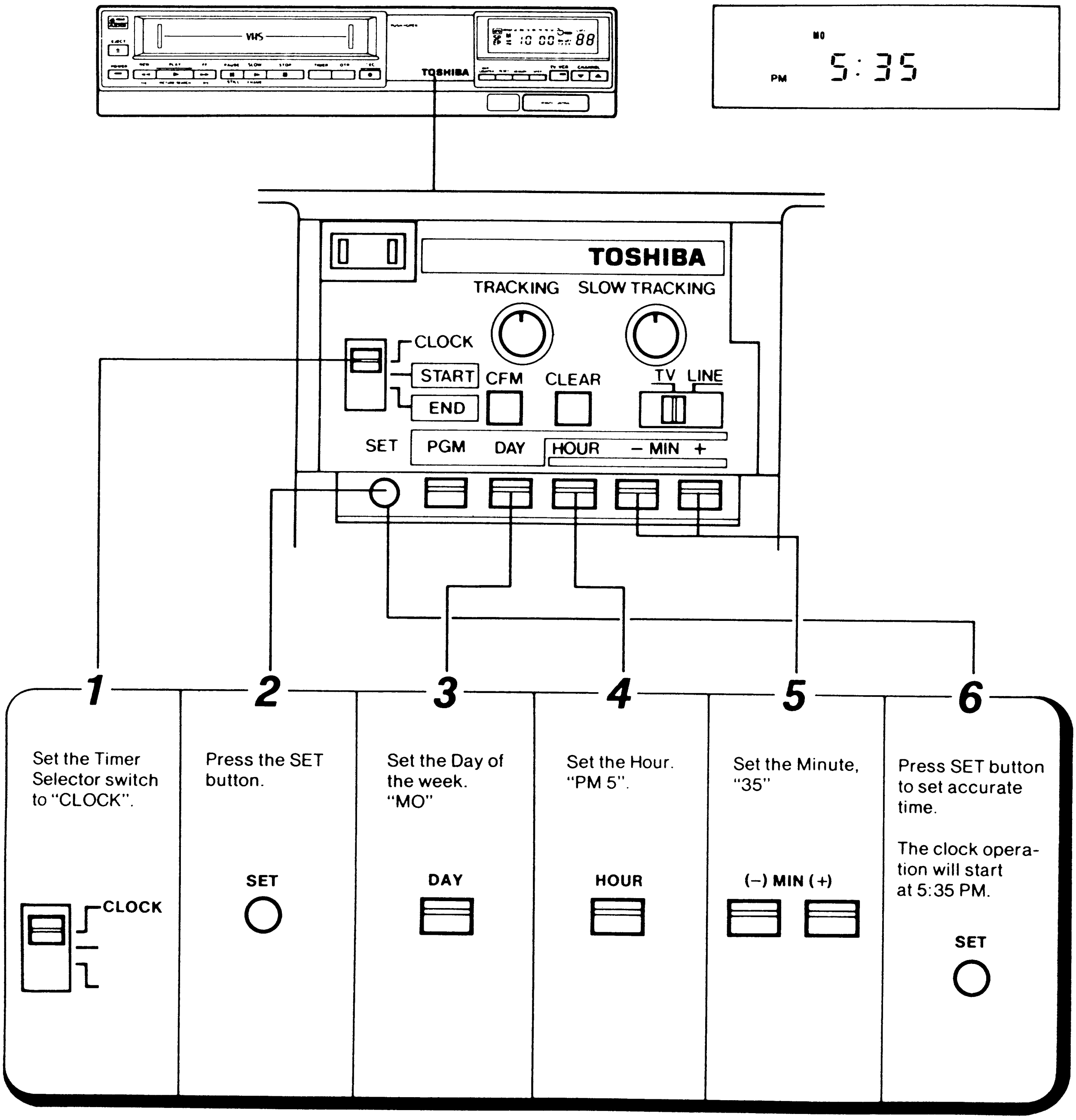
UHF OUT Terminals

UHF IN Terminals

SETTING THE PRESENT TIME

This clock provides a 12-hour display. The time display brightness will automatically darken from 10 PM to 6 AM.

Example: Monday, 5:35 PM


VHS
TOSHIBA
MO
PM 5:35
TOSHIBA
TRACKING
SLOW TRACKING
CLOCK
START
END
CFM
CLEAR
TV
LINE
SET
PGM
DAY
HOUR
– MIN +
CLOCK
SET
DAY
HOUR
(–) MIN (+)
SET

1. Set the Timer Selector switch to "CLOCK".
2. Press the SET button.
3. Set the Day of the week. "MO"
4. Set the Hour. "PM 5".
5. Set the Minute, "35"
6. Press SET button to set accurate time.

   The clock operation will start at 5:35 PM.

When a power interruption occurs:

After about 10 minutes of power interruption, the clock display will flash. Reset the video timer again after setting the clock. The colon (:) blinks for any instantaneous power interruption. The clock will stop in case of power interruption. Reset the clock according to the correct present time.

CHANNEL SELECTION

This setting is preset for VHF Channels 2-13, UHF Channel 18 and CATV Channel 46. If it does not receive in each region, please reset.

Example: Set 2 position to VHF's 12 channel.

① Turn on the TV power supply and set to VCR channel.
② Turn on the VCR power supply.
③ Set the INPUT SELECT switch to "TV."
④ Set the TV/VCR switch to "VCR."
⑤ Open the cover of the tuning section of the VCR .
⑥ Press the PRESET button. (Fig. 1)
····· The fluorescent display will change.
⑦ Press the Channel Button on the front panel to display "2" in the position section. (Fig. 2)
⑧ Press the BAND selector button to select the Band "H". (Fig. 2)

Band Indicator	Band	Channel
L	V_L	2–6,
H	V_H	7-13 A_2A_1A to I
U	U	14-83
C	CATV	J-W, AA to JJ

Fig. 1

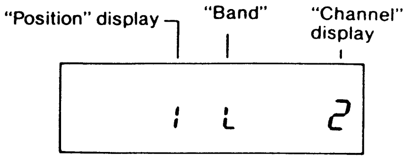

"Position" display
"Band"
"Channel" display
1 L 2

Fig. 2

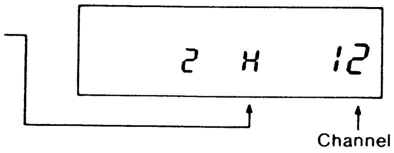
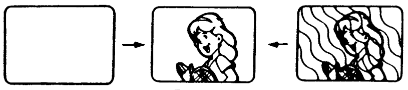
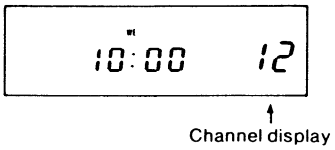

2 H 12
Channel

Fig. 3



Press the "H" button until color appears. Best Picture Press the "L" button until the stripes disappear.

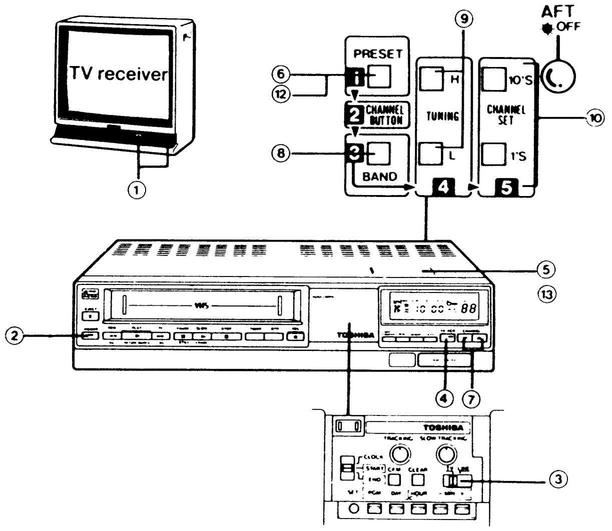
Fig. 4


10:00 12
Channel display

⑨ Press the Tuning Button to receive and adjust a channel. (Fig. 3)
⑩ Press the CHANNEL SET button. (Fig. 2)
10's button ····· press once.
1's button ····· press twice.

Note: After setting, the channel can be selected with the UP/DOWN button. The channel number which has been set on the fluorescent display will be shown.
45 → 30 → 12 → 3 → ····· 5
MAX 16 position can be set.

⑪ Repeat steps 7 – 10 (up to 16 position).
⑫ Press the PRESET button. (Fig. 4)
····· The timer display and the channel number will be appeared.
⑬ Close the Cover.


TV receiver
①
⑨
AFT
OFF
PRESET
⑥
⑫
CHANNEL BUTTON
TUNING
H
L
10'S
CHANNEL SET
1'S
⑩
⑧
BAND
4
5
②
⑤
⑬
TOSHIBA
④
⑦
③

AFT Adjust

Use this system equipment by setting it to AFT OFF for a channel that has poor in radio waves and disturbed by sound noise.
lamp lights AFT OFF.
lamp does not light AFT ON.

To set AFT OFF:
① Select channel for AFT OFF by up/down button.
② Push either tuning H or L button.

To return to AFT ON:
① Push PRESET button.
② Push either tuning H or L button.
③ Push PRESET button.

VIDEO CASSETTE

Recording And Playback

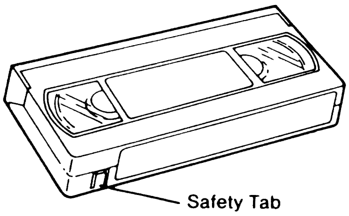
- Only video cassettes with VHS mark can be used. This VCR can record at two different speeds (EP mode: 1.11 cm/sec, and SP mode: 3.34 cm/sec.). It is preset for SP speed. The correct playback speed is selected automatically from among three speeds (EP, LP and SP) by the recorder.

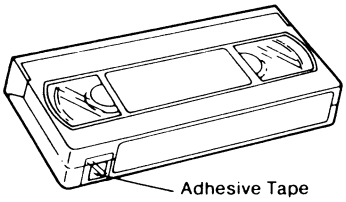
[Performance]

	EP	LP	SP
Recording	○	–	○
Playback	○	○	○

■ When an important recording is to be made, make a trial recording to confirm that picture and sound are normal.

- Video recording can only be performed on one side of a video cassette unlike an audio cassette.
- If a new recording is made on a cassette that was previously recorded, the previous picture and sound are erased, and a new picture and sound are recorded. Remove the tab on the back of the video cassette to prevent accidental erasure of recorded materials.
  Video recording cannot be performed on a cassette with the tab removed.
- Video cassettes are equipped with a safety tab to prevent accidental erasure. When the tab is removed, recording cannot be performed. If you wish to record on a cassette whose tab has already been removed, use adhesive tape to block the hole.





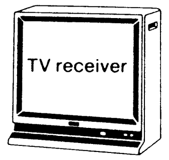
- **Cassettes and maximum recording time**

Record Mode \ Video Cassette	T-160	T-120	T-60	T-30
EP	480 min.	360 min.	180 min.	90 min.
SP	160 min.	120 min.	60 min.	30 min.

RECORDING A TV PROGRAM

1

Turn the TV power on and set the VCR channel. (Channel 3 or 4)



See page 4 for the VCR channel.

2

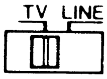
Turn the VCR power on.

POWER

This VCR automatically turns POWER ON when a cassette tape is loaded, even under POWER OFF condition **(AUTO POWER ON)**.

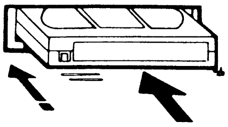
3

Set the INPUT SELECT switch to "TV."

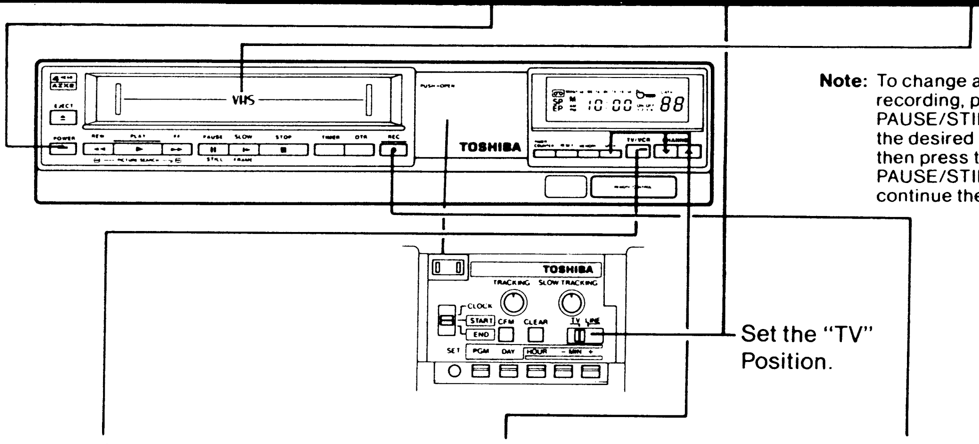


4

Insert a video cassette.



Confirm that the cassette tab is not broken.



Note: To change a channel during recording, press the PAUSE/STILL button, select the desired new channel then press the PAUSE/STILL button to continue the recording.

Set the "TV" Position.

5

Press the TV/VCR button to VCR.

TV/VCR

6

Press the Channel Selector buttons to desired channel. At this time, set the Tape Speed Selector switch to SP or EP.

SP/EP

7

Press the REC button.

REC

• Press the PAUSE/STILL button to eliminate unnecessary material.

Although the program continues on the TV screen, the tape is stopped and video recording is not performed. To resume video recording, press the PAUSE/STILL button again. Unnecessary material can be eliminated with this procedure.

Note: If pause is continued for about 10 minutes, the recorder returns to the stop mode in order to protect the tape and internal video recorder components.

• Viewing another program while recording.

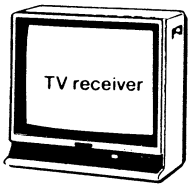
If two desired programs are on at the same time, one program can be viewed while the other is being recorded.

1. Start recording one program by following procedures 1 to 7 above.
2. Press the TV/VCR button to TV. (Lamp goes off.)
3. Select the desired TV channel for viewing by using the TV channel selector of your TV receiver.

PLAYBACK

1

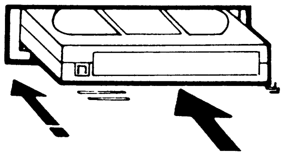
Turn the TV power on and set the VCR channel. (Channel 3 or 4.)



See page 4 for the VCR channel.

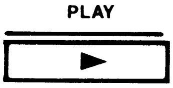
2

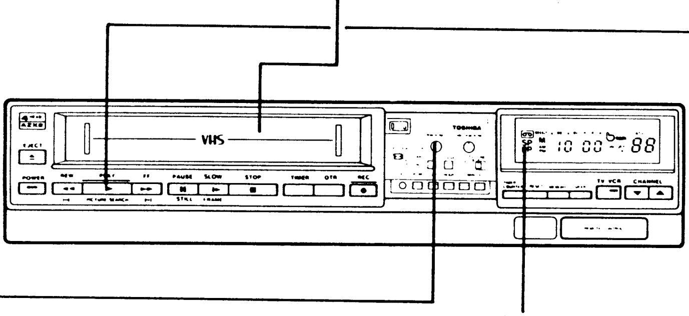
Insert a video cassette correctly.



3

Press the PLAY button.
The playback picture appears on the TV after about 5 seconds.
At this time, TV/VCR button is automatically switched to VCR.

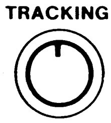




Tape Speed Indicators

4

When a picture noise occurs during PLAY mode, use TRACKING CONTROL to move it out of the way.



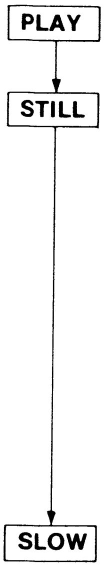
- **Rewind shut off**
  If you press the POWER button while the VCR is in REW mode, power will be automatically cut after tape rewinding (Power lamp flashes during tape rewinding.)

Note: When video cassette tape recorded in the LP mode is played back, the SP/EP modes are not indicated.

- **To stop playback:**
  Press the STOP button.
  Next, press the EJECT button to remove the video cassette. The cassette indicator lamp flashes until the video cassette comes out.
- **Tape speed**
  Video cassettes recorded by SP, LP and EP tape speeds can be viewed with this VCR. The tape speed is automatically set during playback.
- **Auto Rewind**
  When a video cassette tape ends during playback and recording (except timer recording), the auto rewind automatically rewinds the tape.
- **Auto Play**
  If you press the PLAY button while the REW button is pressed, the tape will be rewound to the counter position "0000" and stop if the counter memory is ON, automatically followed by conversion into the PLAY mode.
  If the counter memory is OFF, the tape will be rewound to the starting position and stop, automatically followed by conversion into the PLAY mode.

Notes:
1. The lamp of the PLAY button flashes during tape rewinding in AUTO PLAY mode.
2. Automatic conversion in PLAY mode is possible only once after each rewinding.

OTHER PLAYBACK MODES



Normal playback

Still picture playback

To still the pictures press the PAUSE/STILL button during PLAY mode.

1. If the picture blurs during STILL, adjust the V-LOCK to correspond to the recording mode, and then enjoy the clear picture.
2. If there is noise during STILL, press the SLOW button to enter the SLOW mode. With the noise out of the way, use SLOW TRACKING to enjoy the STILL picture.

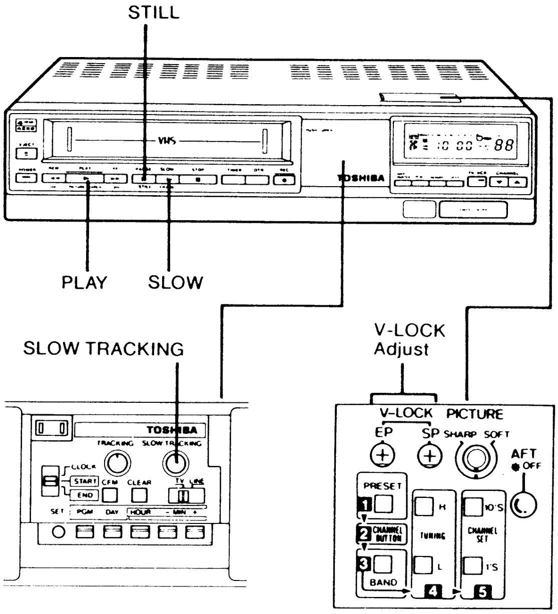
For frame by frame operation

Press and release SLOW button to advance the picture one frame at a few time.

When noise bars occur during slow playback, use slow tracking to move the noise bars to the top or the bottom of the screen to give the best picture.

SLOW playback

Slow playback at 1/10 the speed of normal playback can be viewed while the SLOW button is pressed.



Notes:

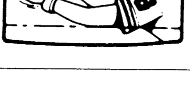
1. The sound is muted and picture noise may occasionally occur during still/slow picture playback. This does not indicate a malfunction.
2. Still/slow picture returns to normal playback after about 5 minutes to protect the tape.
3. During still, slow, and picture search operations, the LP mode pictures will be distorted.

PICTURE SEARCH/ACCEL SEARCH

Review or Cue allow playback at about 5 times the normal speed, and can be performed with quick search. It is very convenient during search for a particular section on the tape. When the REW or FF button is left depressed, search can be performed at about 15 times normal speed (only for tape recorded in the EP mode).

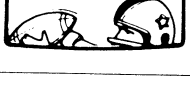
① Press the PLAY button.	② Press the REW or FF button.	③ Leave the REW or FF button depressed.	④ Press the PLAY button.
Normal playback.	Rewind playback (fast forward playback) at about 5 times normal speed	(ACCEL SEARCH) When the REW or FF button is left depressed, search can be performed at about 15 times normal speed (only for tape recorded in the EP mode).	Normal playback.

- Several static horizontal noise lines will appear during picture search. The sound is muted.



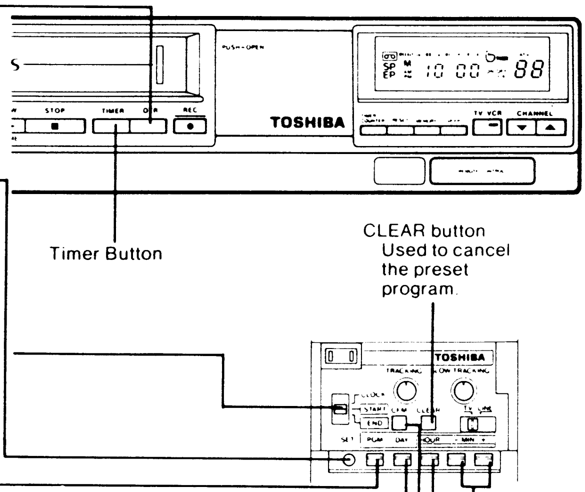
- When the picture is shifted horizontally during picture search, adjust the TV horizontal control knob.

- When the picture shifts vertically during picture search, adjust the TV vertical control knob.



PROGRAMMABLE TIMER

- Four programs can be preset for specified days within the week, the same day of every week, on weekdays (Monday to Saturday), and everyday (Sunday to Saturday).
- If power to the VCR is interrupted, the clock stops to run and the programmed instructions will be retained for about 10 minutes. If the colon flashes, set the present time again.
  After 10 minutes of power interruption, if the clock flashes SU ... SA AM 12:00, the clock and program contents will have to be reset.
  Note:
  The clock will stop running during power interruption. If the colon (:) blinks, make sure to reset the clock according to the present time.
- The clock used is of the 12-hour type.
- Tape speed (EP or SP) can be adjusted for every program.
- Setting for timer recording is possible in either mode, POWER ON or OFF.



OTR Button
- Used to carry out recording in units of 30 minutes in normal mode.
  Present time → 30 min → 60 min → 90 ········· 240 min

SET button
- Used to set the present time.
- When this button is pressed once, the unit enters clock set mode. When the button is pressed again, clock set mode is released.

Timer Selector Switch
- CLOCK mode
  For the present time display.
- START mode
  For setting the timer on time.
- END mode
  For setting the timer off time.

PGM Button
- Used to specify the program number 1–4.

DAY Button
- Used to set the day of the week.
- When the button is pressed once, the day of the week advances by one. When the button is kept pressed, the days advance rapidly.

<**Example**>
One day of the week; "SU"
Same day of every week; "WEEKLY SU"
Weekday; "MO ... SA"
Everyday; "SU. MO. TU. . . SA"

"CFM Button"
- When this button is pressed, preset contents can be verified in order from program 1 to program 4.

MIN (–)/(+) Button
- Used to set the minute digits.
- When the button is pressed once, the digit advances by 1.
  When the button is kept pressed, the digits advance rapidly.
  MIN(+) ☐ 00 → 01 → 02 → 03 - - → 59
  MIN(–) ☐ 00 → 59 → 58 ········· 01

HOUR Button
- Used to set the hours.
- When the button is pressed once, the digit advances by 1.
  When the button is kept depressed, the digits advance rapidly.

SETTING THE PROGRAMMABLE TIMER

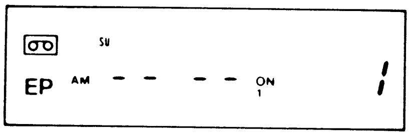
- Confirm the present time. If the present time is not correct, set it again.
- Insert the cassette (check that the cassette safety tab has not been removed.)
- When setting the programmable timer, be careful not to overlap recording time zone. Monitor the program by pressing the CFM button.
- Preset desired programs as follows.

1. Set the Timer Selector switch to START.
2. Specify the program number 1–with the "PGM" button.
3. Set the day of the week, the hour and minutes of recording on time (SU → MO → - - - - - → SA → WEEKLY SU → WEEKLY MO → - - - - - → WEEKLY SA → MO, - - - - , SA → SU, MO, - - - - , SA) with "DAY", "HOUR" and "MIN (–)/(+)" buttons.
4. Select the program you want to see with the Channel Selector buttons.
5. Set the Tape speed "EP" or "SP".
6. Set the Timer Selector switch to END.
7. Set the end time with "HOUR" and "MIN" buttons.
8. To preset more programs repeat steps 1 – 7. (Max. 4 programs).
9. Return the Timer Selector switch to CLOCK.
10. Press the TIMER button.

Timer recording

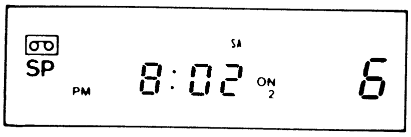
Example: To set channel 6 on Saturday from PM 8:02 to PM 9:45 as program 2. (Present day/time, Tuesday, AM 8:21.) "SP" mode

(1) Set the Timer Selector switch to START.

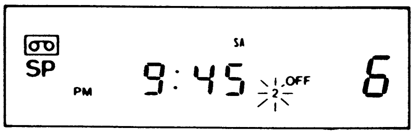


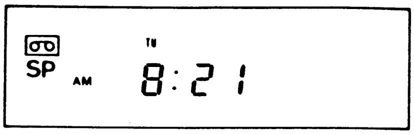
(When timer is not set to program 1)

(2) Set the program number	"2"
(3) Set the day of the week	"SA"
(4) Set the timer on hour	"PM 8"
(5) Set the timer on minute	"02"
(6) Set the recording channel	"6"
(7) Set the tape speed "EP" or "SP"	"SP"

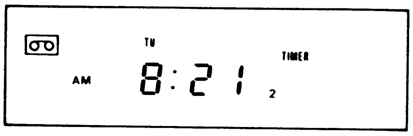


(8) Set the Timer Selector switch to END.
(9) Set the timer off hour .... "PM 9"
(10) Set the timer off minute .... "45"





(11) Set the Timer Selector switch to CLOCK.
The display returns to the present time display and the program number goes off.
(12) Monitor the program by pressing the CFM button.
(13) Press the TIMER button.



Note: Timer advances during setting.

Press the TIMER button to end the timer setting.

TIMER is displayed and the power indicator goes off.

Notes:

1. When no cassette is loaded or the tab of the cassette has been removed, timer recording is not possible. When no cassette is loaded, "E" is displayed at the first digit of the timer while the TIMER button is pressed. When the safety tab of the cassette has been removed, the cassette will be rejected automatically.
2. During timer recording, the preset contents (program number, channel, day of the week of timer on/off time) cannot be changed.

To cancel the timer setting

(1) Set the Timer Selector switch to START.
(2) Press the "PGM" button to display the program number to be cancelled.
(3) Press the "CLEAR" button. The timer on/off time and channel are erased.
Note:
- The timer setting can be cancelled when the Timer Selector switch is set to START.

ONE TOUCH TIMER RECORDING

The One Touch timer recording function permits unattended recording for a maximum of 4 hours. Also, each time the OTR button is pressed during normal mode the recording time is extended 30 minutes. When setting the time, timer off time can be set in 30 minute increments after setting the timer off time.

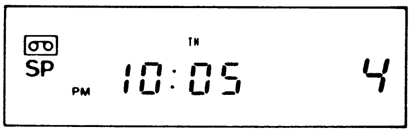
Notes: 1. Thirty minutes are added every time the OTR button is pressed for up to 4 hours (8 times). The one touch timer can only be set in 30-minute units. When the OTR button is pressed several times, press the TIMER button within 9 seconds. After 9 seconds have elapsed, display returns to present time.

2. One touch timer operation is possible only when power is supplied and the Timer Selector switch is set to CLOCK.

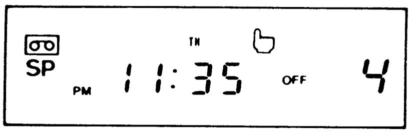
Example: To record channel 4 starting from now for 1-1/2 hours. (Present day/time, Thursday, PM 10:05) Tape speed "SP" mode

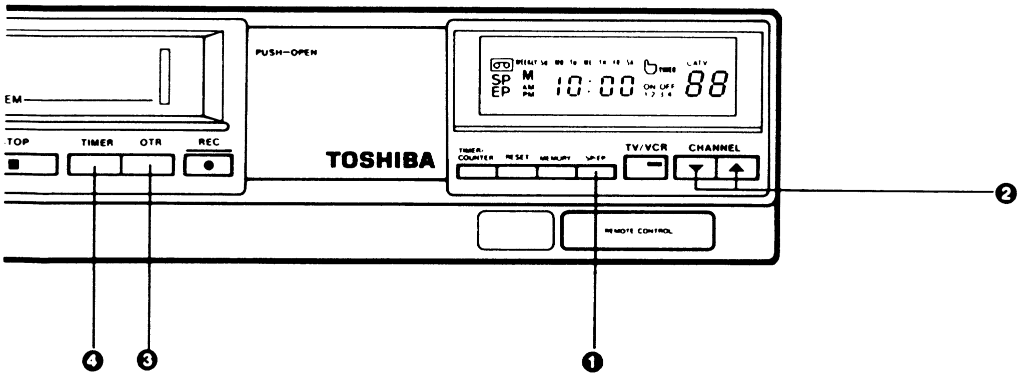
(1) Set the Tape Speed Selector to "SP".
(2) Select channel 4 by pressing channel selector button.
(3) Press the OTR button to set the recording time.
When the button is pressed once: PM 10:35 (30 minutes)
When the button is pressed twice: PM 11:05 (1 hour)
When the button is pressed three times: PM 11:35 (1 hour 30 minutes)
(4) Press the TIMER button within 9 seconds.

Present time

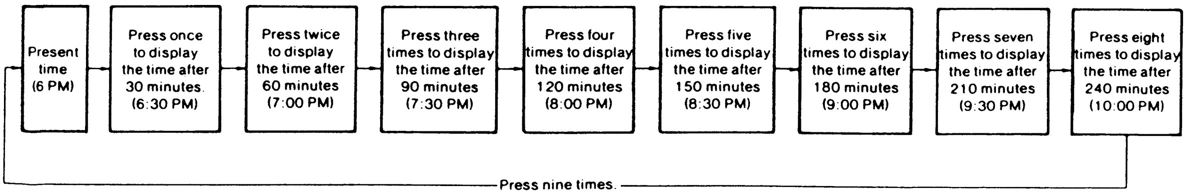


Timer off time





ONE TOUCH TIMER CYCLE

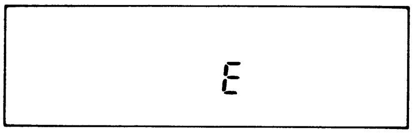

Present time (6 PM)
Press once to display the time after 30 minutes. (6:30 PM)
Press twice to display the time after 60 minutes (7:00 PM)
Press three times to display the time after 90 minutes (7:30 PM)
Press four times to display the time after 120 minutes (8:00 PM)
Press five times to display the time after 150 minutes (8:30 PM)
Press six times to display the time after 180 minutes (9:00 PM)
Press seven times to display the time after 210 minutes (9:30 PM)
Press eight times to display the time after 240 minutes (10:00 PM)
Press nine times.

Example: To set channel 6 starting from Saturday, PM 8:02 for 1 hour as program 1. (Present day/time, Tuesday, AM 8:21)

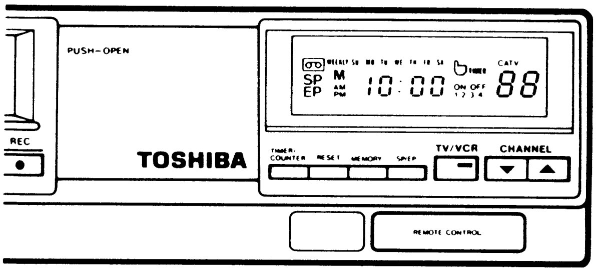
(1) For the program, channel and timer on time setting, refer to steps (1)–(5) of "Setting the programmable timer".
(2) Set the Timer Selector switch to END.
(3) Press the OTR button twice.
(4) Set the Timer Selector switch to CLOCK.
(5) Press the TIMER button to complete the timer setting.
"TIMER" indicator lights.

Note:
When the OTR button is pressed once, the time increases by 30 minutes.
30 min → 60 min → 90 min → 120 min → 150 min → 180 min . . . →

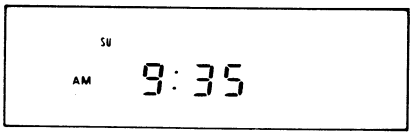
Error indication
When the TIMER button is pressed without setting the timer on/off time, or no cassette is loaded, the "E" indicator lights (when the TIMER button is pressed).



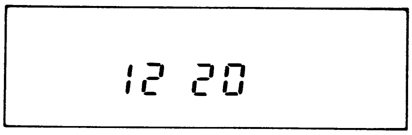
TIMER/COUNTER display: The indication of TIMER/COUNTER display can be changed with TIMER/COUNTER button.


PUSH-OPEN
REC
TOSHIBA
WEEKLY SU MO TU WE TH FR SA
TIMER
CATV
SP
EP
M
AM
PM
10:00
ON OFF
88
TIMER COUNTER
RESET
MEMORY
SPEED
TV/VCR
CHANNEL
REMOTE CONTROL

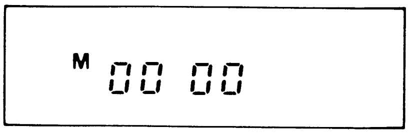
Timer Display



Counter Display



MEMORY function: When the MEMORY button is pressed, the "M" indicator is displayed and the tape stops at the set counter reading 0000 during rewinding. (This function operates for FF and REW modes.)

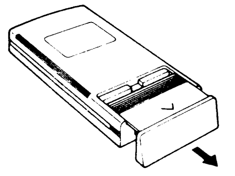


Notes:
1. The counter operates even when it functions as a clock display.
2. The counter display ranges between 9996 to 0005, and does not operate in case of fastforward and rewind.

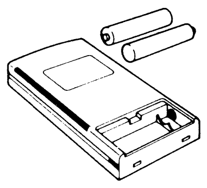
REMOTE CONTROL OPERATION

INSTALLING BATTERIES

How to install batteries in the Remote Control Unit

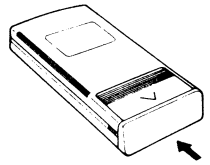


Remove the battery cover on the reverse side of the unit.



Install 2 batteries ("AAA" size) into the unit.

Note: Carefully install batteries to match the polarity diagrams.

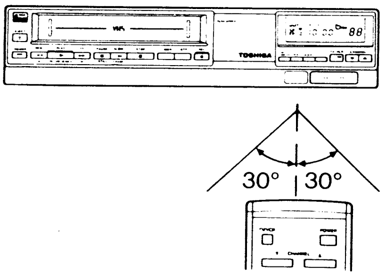


Close the battery cover.

REMOTE CONTROL OPERATION RANGE

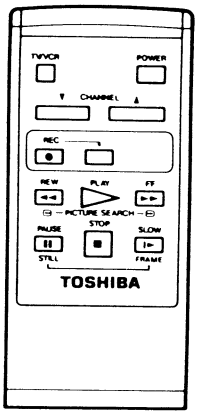
The Remote Control must have a clear line of sight to the sensor on the front of the VCR. It must be within an angle of 30° either side of center. The maximum operating distance is about 5 m.

Point the front end of the Remote Control at the VCR.



REMOTE CONTROL BUTTON FUNCTIONS

The remote control unit allows remote operation of 17 modes:
PLAYback, STILL picture, SLOW playback, Frame advance, CUE, REVIEW, Fast Forward, Rewind, PAUSE, STOP, TV/VCR, CHANNEL up, CHANNEL down, REC, ACCEL SEARCH (Forward/Reverse), and POWER ON/OFF.



Notes:

1. Remote control cannot be operated in the following conditions:
   1) In timer recording mode
   2) Without a cassette in the cassette compartment
   However, TV/VCR, POWER modes can be operated by remote control.
2. When using remote control unit, press control buttons at intervals of about one second to ensure correct operation.
3. If the noise bars appear in the middle of still picture, follow the steps outlined below to move the noise out of the way and then enjoy the STILL picture.
   1) Press the STILL button (In play mode).
   2) Press SLOW button (In slow mode).
   3) Adjust to move the noise out of the way by slow tracking control.
   4) Press Play button (In play mode).
   5) Press STILL button.
4. If the remote control unit is not to be used for a long period of time, remove the batteries to avoid possible damage from battery corrosion.
5. Keep unit away from extremely hot or humid places and avoid mechanical shock.
6. For REC operation, press "REC" button and the right-side button at the same time.

CAMERA RECORDING

Camera recording can be easily performed indoors by following this simple procedure.

1

Connect the video camera. Turn the VCR and TV power on, then insert a cassette. (Set the TV to the VCR channel).

POWER

2

Turn the camera AC adaptor (optional) power on. Set the INPUT SELECT switch to "LINE".

TV LINE

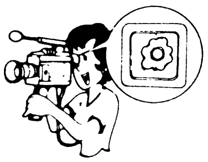
3

Press the TV/VCR button to VCR. The picture is shown on the TV.

TV/VCR

4

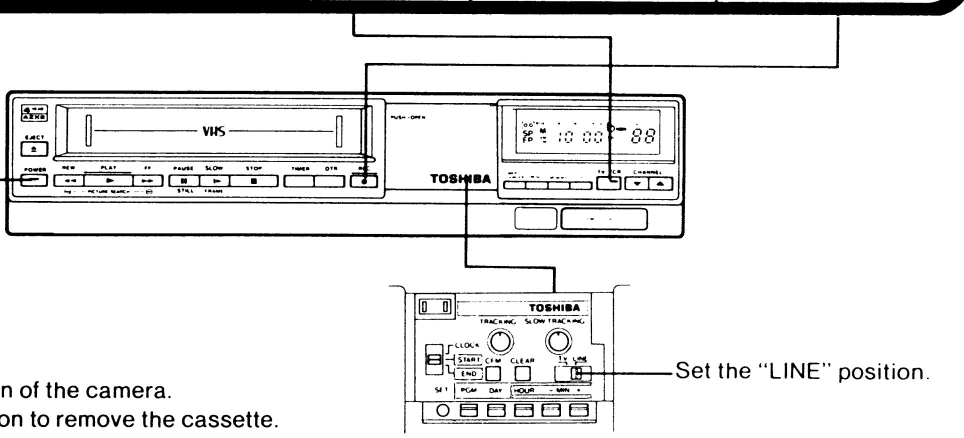
Adjust the camera. (See the camera owner's manual.)



5

Press the REC button.

REC



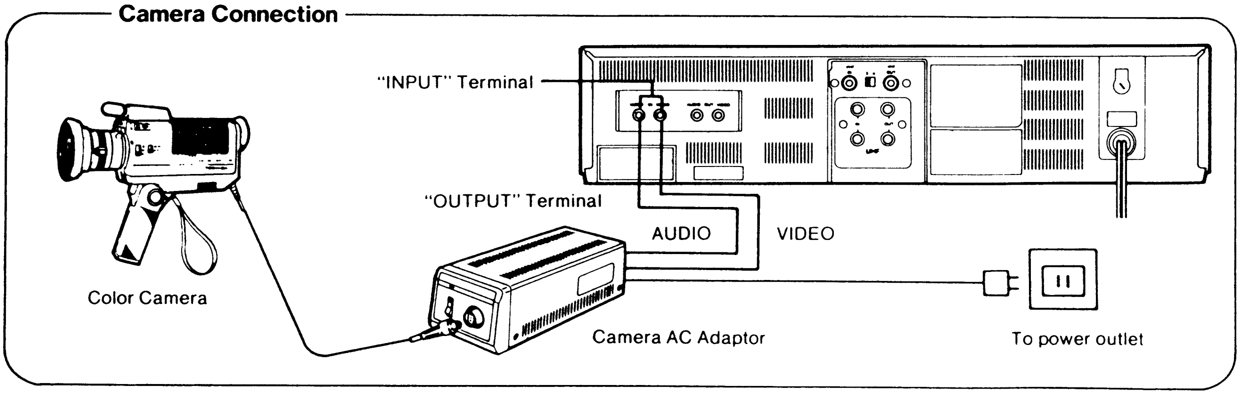
Set the "LINE" position.

- **To stop recording:**
  Press the STOP button of the camera.
  Press the EJECT button to remove the cassette.

- **To stop recording temporarily during video recording:**
  Press the PAUSE/STILL button.
  Press it again, then recording starts again. If pause continues for about 10 minutes, the VCR stops to protect the cassette tape and internal video recording components.

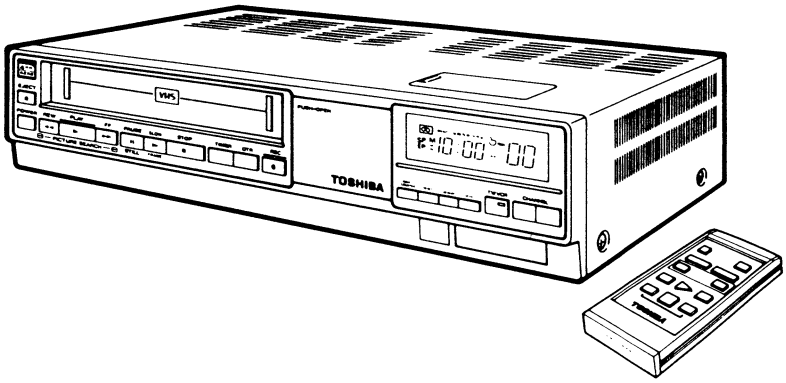
- **When a "beep" sounds during recording:**
  This occurs because the camera's built-in microphone is too close to the TV speaker. Move the camera away from the TV or reduce the TV speaker volume.

Camera Connection



SERVICE DATA
FILE NO.030-145-2

TOSHIBA
COLOR VIDEO CASSETTE RECORDER
M-5530TL
SERVICING DIAGRAMS



SPECIFICATIONS

GENERAL

Video recording system:	Rotary 2-head helical scanning
Head configuration:	4-head rotary (Dedicated heads for SP & EP)
Video signal:	EIA standard NTSC color
Storage temperature:	−20°C to +60°C (−4°F to +140°F)
Operating temperature:	5°C to 40°C (41°F to 104°F)
Antenna:	75 ohms external antenna terminal for VHF 300 ohms external antenna terminal for UHF
Channel coverage:	VHF channels 2 – 13 UHF channels 14 – 83 CATV channels A_2, A_1, A – I, J – W, AA – JJ
VHF output signal:	Channel 3 or 4 (selectable) 73 dBμ, 75 ohms unbalanced

SETTING POSITION	CHANNEL
VL ch	2 – 6
VH ch	A_2, A_1, A – I, 7 – 13
U ch	14 – 83
CATV ch	J – W, AA – JJ

Power consumption:	34W (8W with power off)
Weight:	17.2 lb.
Dimensions:	16-15/16 x 3-3/4 x 14-3/4 inches (W.H.D)

VIDEO

Input:	VIDEO LINE IN: Phono jack 1.0V(p-p) 75 ohms unbalanced, sync. negative
Output:	VIDEO LINE OUT: Phono jack 1.0V(p-p) 75 ohms unbalanced, sync. negative
Signal to noise ratio:	[SP]: 45 dB

AUDIO

Input:	AUDIO LINE IN: Phono jack, 47k ohms, −10 dBs, unbalanced
Output:	AUDIO LINE OUT: Phono jack, less than 10k ohms, −7 dBs, unbalanced (load: more than 47k ohms)
Frequency response:	[SP]: 80 Hz to 12 kHz
Signal to noise ratio:	[SP]: Better than 40 dB

TAPE TRANSPORT

Tape speed:	SP 33.35 mm/sec., LP16.67 mm/sec., EP 11.12 mm/sec.
Maximum recording time:	480 min. with T-160 tape (EP mode)
Fast forward time:	Within 5.0 min. (T-120)
Rewind time:	Within 5.0 min. (T-120)

TIMER

Fluorescent digital display
Count down from AC line frequency.

Remote Control Unit

12 key: 17 modes. Infared Remote Control Operation

Design and specifications are subject to change without notice.

Caution: The unauthorized recording of television programmes and other materials may infringe on the rights of others.

SAFETY NOTICE

SAFETY PRECAUTIONS

LEAKAGE CURRENT CHECK

Plug the AC line cord directly into a 120V AC outlet (do not use an isolation transformer for this check). Use an AC voltmeter, having 5000 ohms per volt or more sensitivity.

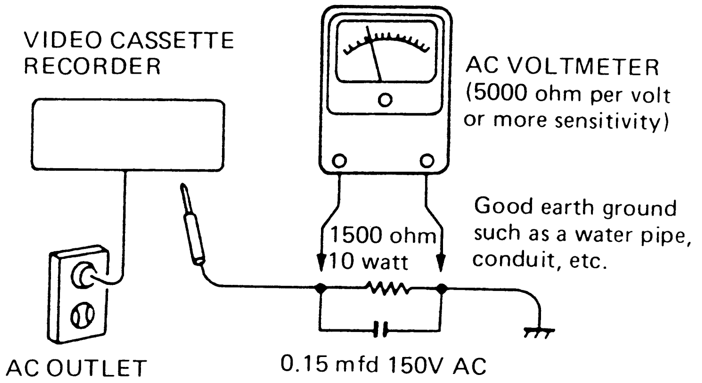
Connect a 1500 ohm 10 watt resistor, paralleled by a 0.15 mfd 150V AC capacitor between a known good earth ground (water pipe, conduit, etc.) and all exposed metal parts of cabinet (antennas, handle bracket, metal cabinet, screwheads, metal overlays, control shafts, etc.).

Measure the AC voltage across the 1500 ohm resistor. The test must be conducted with the AC switch on and then repeated with the AC switch off. The AC voltage indicated by the meter may not exceed 0.3 volts. A reading exceeding 0.3 volts indicates that a dangerous potential exists, the fault must be located and corrected.

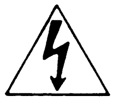
Repeat the above test with the VCR power plug reversed.

NEVER RETURN A VCR TO THE CUSTOMER WITHOUT TAKING NECESSARY CORRECTIVE ACTION.

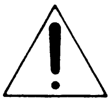
READING SHOULD NOT EXCEED 0.3V


VIDEO CASSETTE RECORDER
AC VOLTMETER (5000 ohm per volt or more sensitivity)
Good earth ground such as a water pipe, conduit, etc.
1500 ohm 10 watt
AC OUTLET
0.15 mfd 150V AC

Test all exposed metal.
Voltmeter Hook-up for Leakage Current Check



The lightning flash with arrowhead symbol, within an equilateral triangle, is intended to alert the user to the presence of uninsulated "dangerous voltage" within the product's enclosure that may be of sufficient magnitude to constitute a risk of electric shock to persons.



The exclamation point within an equilateral triangle is intended to alert the user to the presence of important operating and maintenance (servicing) instructions in the literature accompanying the appliance.

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1. Inspection Procedure

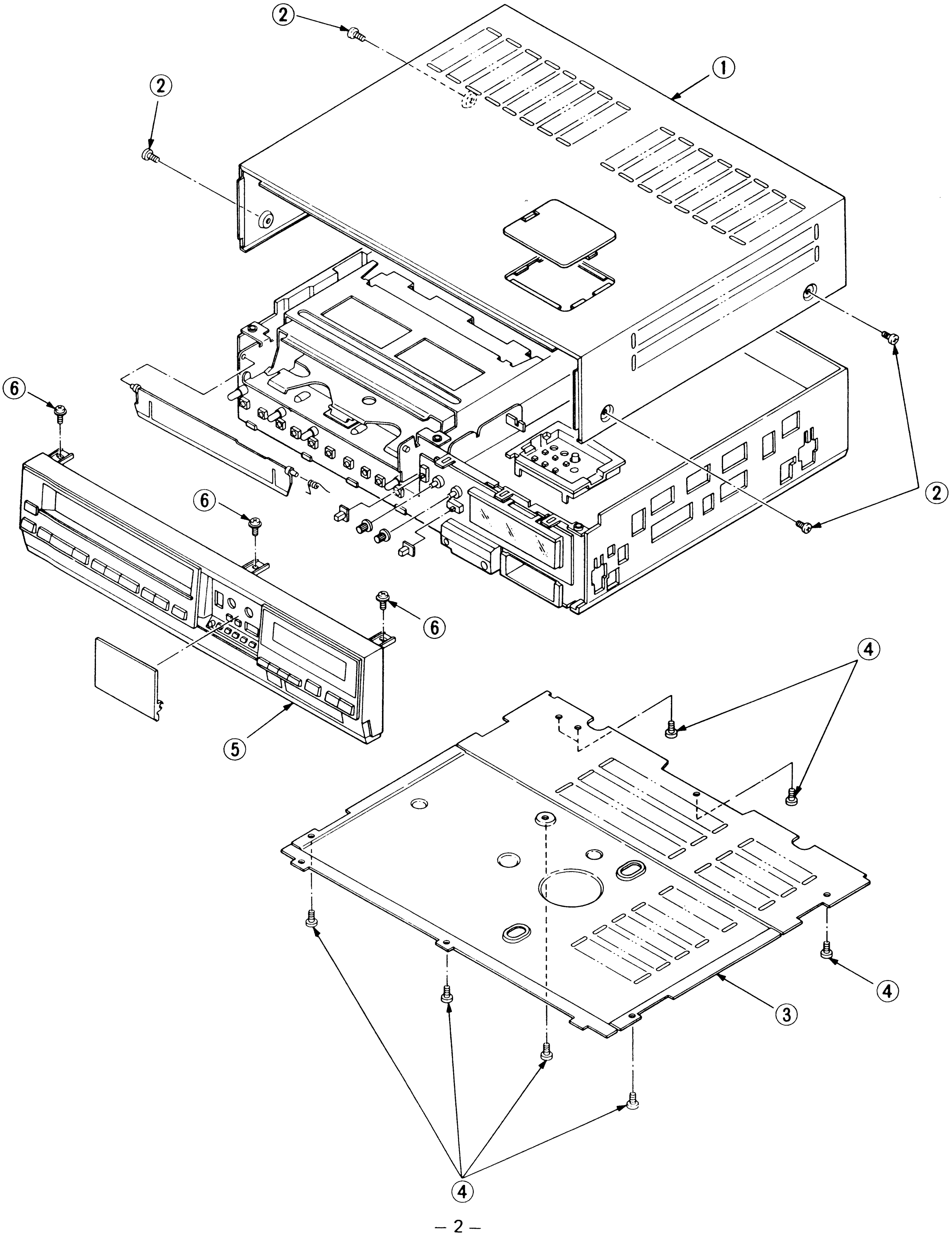
Operation steps		Items to be confirmed	Inspection block	Page	
				Block Diagram	Circuit Diagram
1. AC Plug-in	Time setting Program timer setting	Clock display Time setting operation	Power (AC system) Timer counter	12 16	34 44
2. Power SW ON	Timer/counter, memory SP/EP, TV/VCR SW (in VCR) Channel selection AFT operation, EE picture & tone quality, TV/VCR switch (in TV)	Mode display lamp TV receive condition Channel select operation, AFT operation level, EE picture quality, Tone Signal level	Power Logic RF, reception Video (EE, Rec mode) Audio (EE, Rec mode)	12 20 14 28 31	34 50 38 62 67
3. Cassette-in and Cassette-out	Cassette-in Cassette loading Eject Cassette out	F/L mecha. operation Cassette loading operation Eject operation Indicator lamp Abnormal sound	Logic	20	50
4. Key entry Operation Remote-control	REC, PLAY Cue/Review Still, Frame feeding/slow FF/REW Memory/Auto play (REW ON → PLAY ON)	Indicator lamp Each mode operation (Tape drive operation) Abnormal sound Memory, auto play operation	Logic Remote control block	20 68	50 69
5. Special Functions Auto Power ON Auto Rewind Shut OFF Auto Rewind	Cassette-in at Power OFF Power off during REW REC/PLAY/CUE	Power ON, Cassette down Power OFF after REW Rewind automatically after tape wound	Power Logic	12 20	34 50
6. Playback Function Picture Quality Tone Quality Others	PLAY (Test tape: MH-1/MH-1L) Cue/Review Still/Slow	Resolution, S/N Hue, Saturation, Color unevenness, Color dropout, Sound distortion, Level variation, Picture noise, Jitter, Picture swing, Skew distortion, Flicker, Beat	Video PLAY system Audio PLAY system Servo system	28 31 25	62 67 56
7. REC/PLAY Functions Picture Quality Tone Quality Others	REC/PLAY	Resolution, S/N Hue, Saturation, Color unevenness, Color dropout, Sound distortion, Level variation, Picture noise, Jitter, Picture swing, Skew distortion, Flicker, Beat	Video PLAY system Audio PLAY system Servo system	28 31 25	62 67 56

How to use the table

1. When inspecting a defective VCR, proceed according to the steps shown in the table.
2. Check the items to be confirmed for each operation step.
3. If a problem is found on the item, check waveforms (level) referring to the block diagram relating to the items.
4. Use PC board pattern diagram and schematic diagram to examine the circuit precisely.
5. After completion of the repair work, check steps 1 ∿ 7 again.

2. Removal of Cabinet

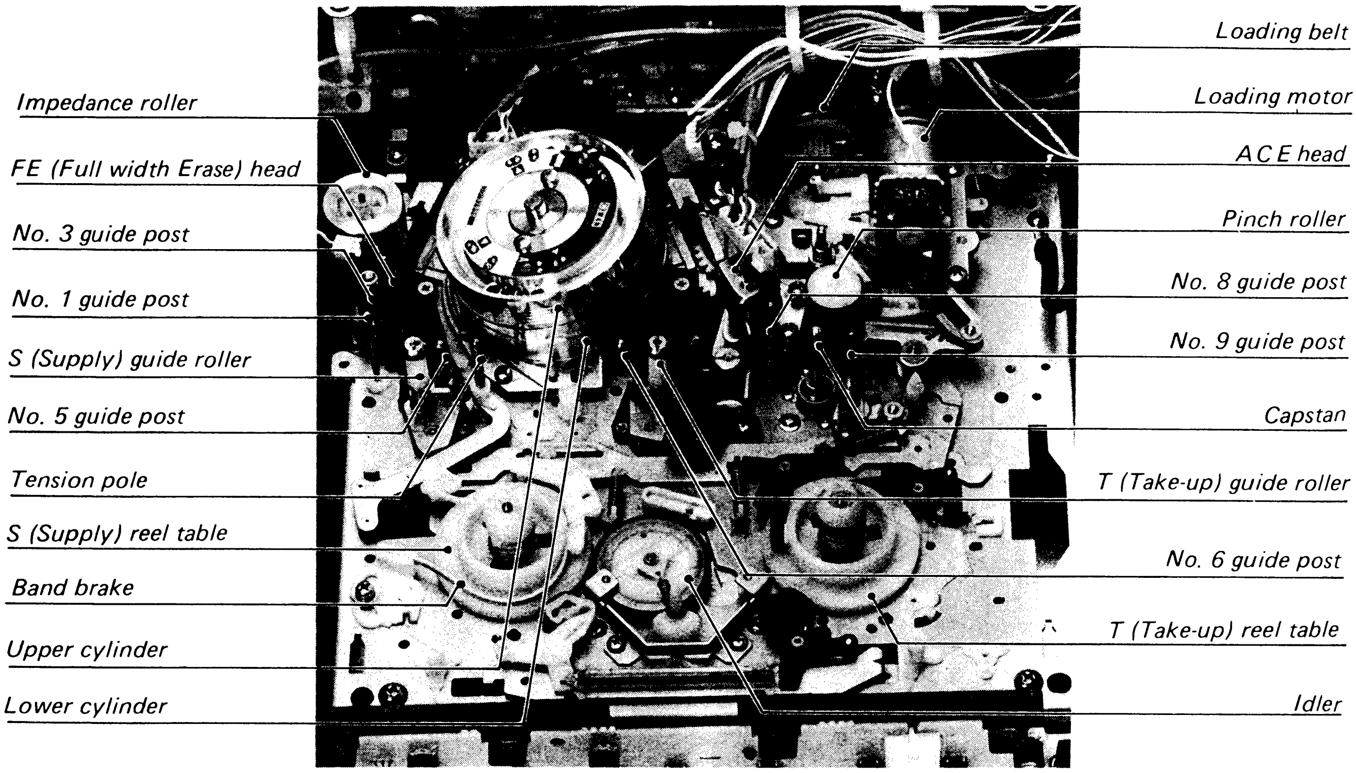
(1) Disconnect power cord plug from AC outlet.
(2) Remove 4 screws ② securing top cover ①.
(3) Remove the top cover ① by sliding it backward.
(4) Remove 8 screws ④ securing bottom cover ③, then remove the bottom cover.
(5) Remove 3 screws ⑥ securing front panel ⑤.
(6) Remove the front panel ⑤.



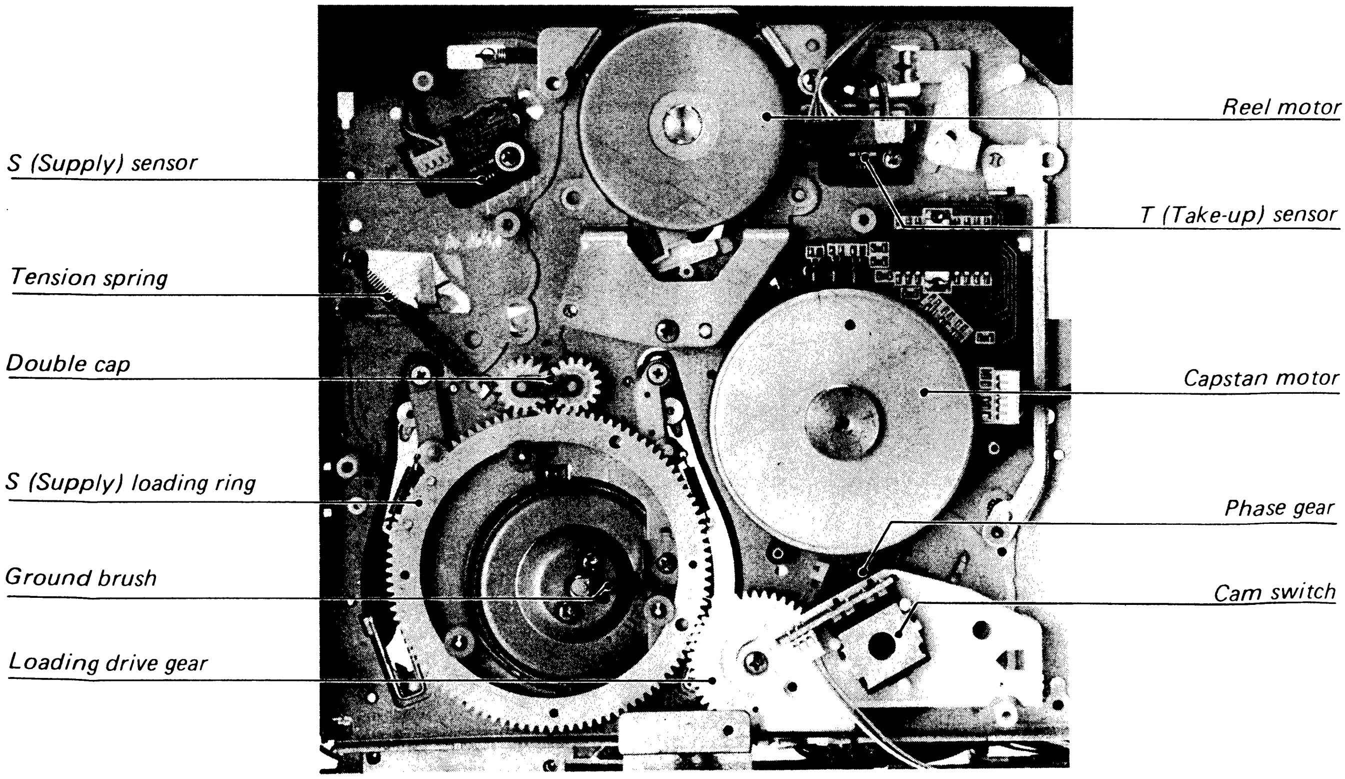
3. Mechanical Parts Location

MECHANICAL DECK SECTION

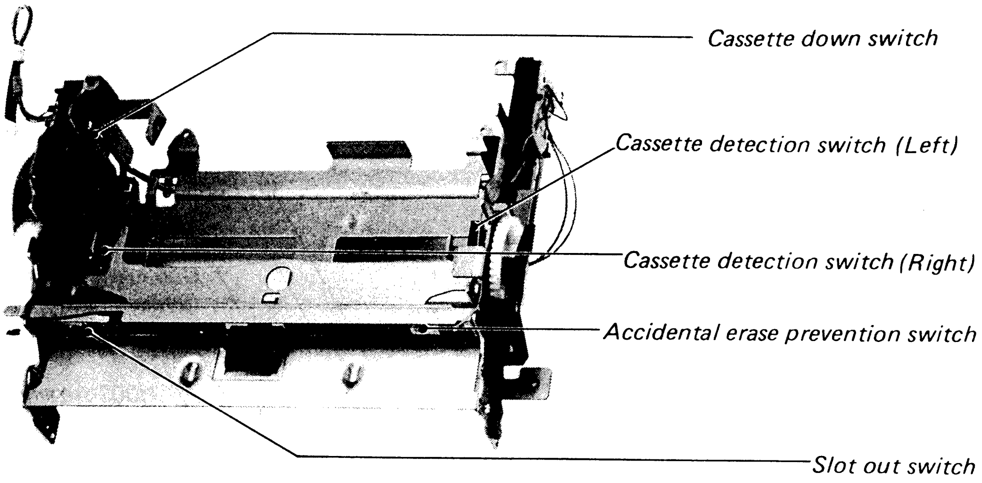
Top View

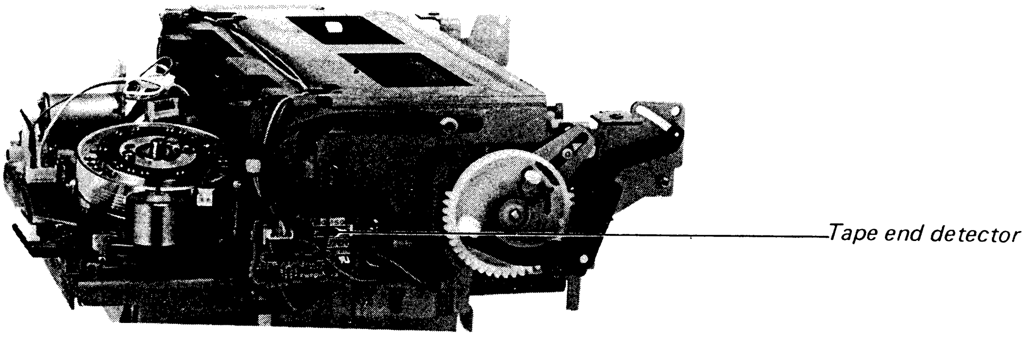

Impedance roller
FE (Full width Erase) head
No. 3 guide post
No. 1 guide post
S (Supply) guide roller
No. 5 guide post
Tension pole
S (Supply) reel table
Band brake
Upper cylinder
Lower cylinder
Loading belt
Loading motor
A C E head
Pinch roller
No. 8 guide post
No. 9 guide post
Capstan
T (Take-up) guide roller
No. 6 guide post
T (Take-up) reel table
Idler

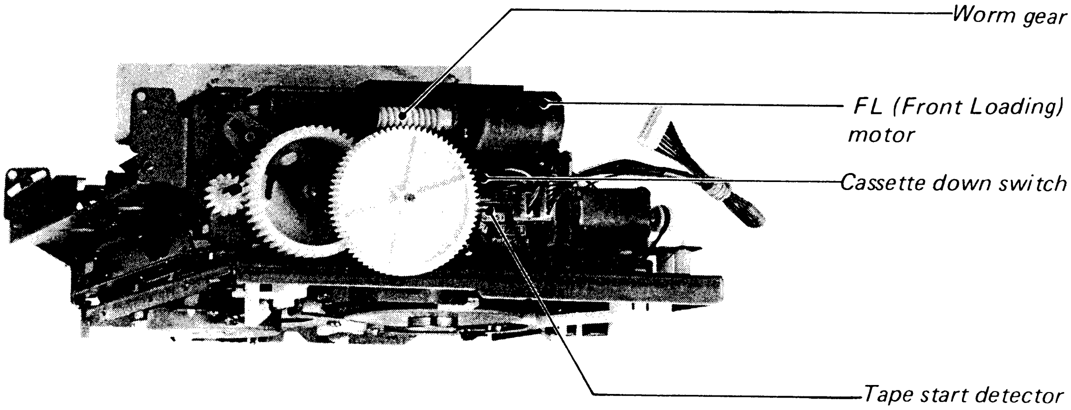
Bottom View


S (Supply) sensor
Tension spring
Double cap
S (Supply) loading ring
Ground brush
Loading drive gear
Reel motor
T (Take-up) sensor
Capstan motor
Phase gear
Cam switch

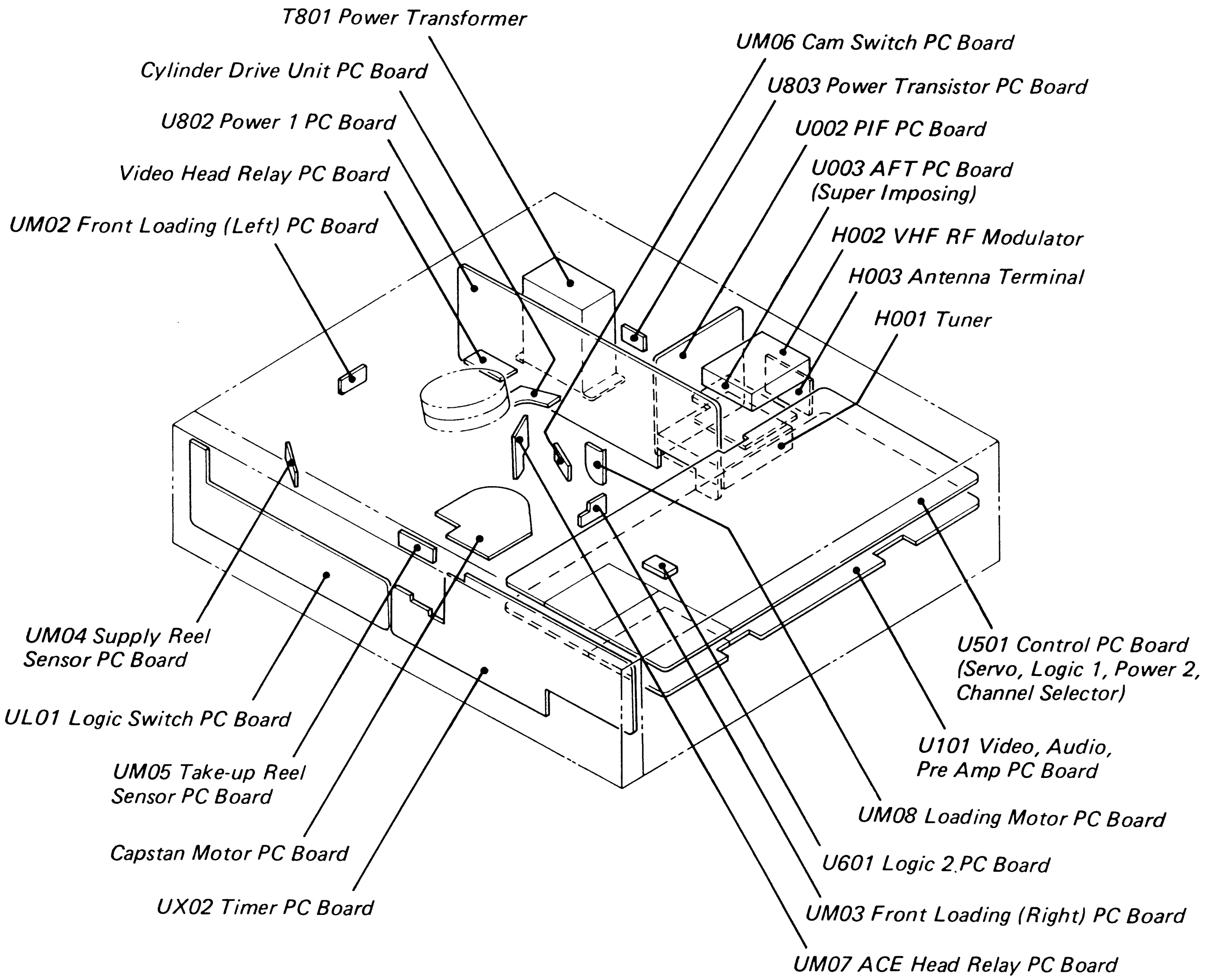
FRONT LOADING SECTION


Cassette down switch
Cassette detection switch (Left)
Cassette detection switch (Right)
Accidental erase prevention switch
Slot out switch


Tape end detector


Worm gear
FL (Front Loading) motor
Cassette down switch
Tape start detector

4. Electrical Units Location Diagram

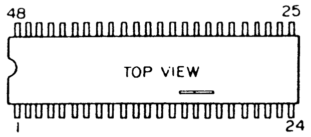
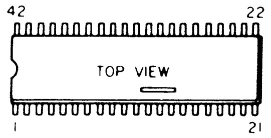
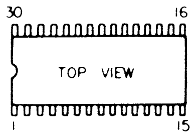
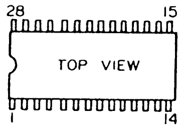
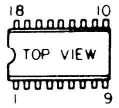
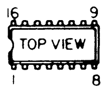
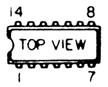
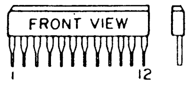
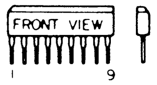

T801 Power Transformer
Cylinder Drive Unit PC Board
U802 Power 1 PC Board
Video Head Relay PC Board
UM02 Front Loading (Left) PC Board
UM06 Cam Switch PC Board
U803 Power Transistor PC Board
U002 PIF PC Board
U003 AFT PC Board (Super Imposing)
H002 VHF RF Modulator
H003 Antenna Terminal
H001 Tuner
UM04 Supply Reel Sensor PC Board
UL01 Logic Switch PC Board
UM05 Take-up Reel Sensor PC Board
Capstan Motor PC Board
UX02 Timer PC Board
U501 Control PC Board (Servo, Logic 1, Power 2, Channel Selector)
U101 Video, Audio, Pre Amp PC Board
UM08 Loading Motor PC Board
U601 Logic 2.PC Board
UM03 Front Loading (Right) PC Board
UM07 ACE Head Relay PC Board

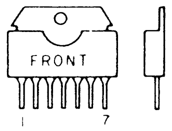
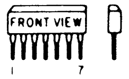
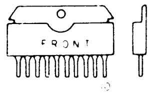
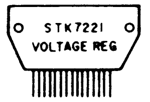
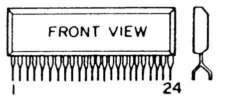
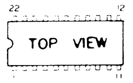
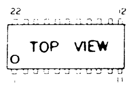
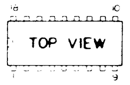
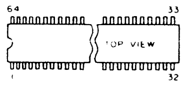
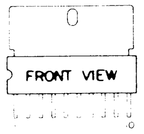
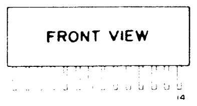
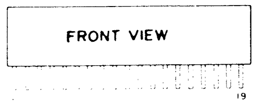
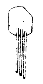
5. Part Configuration and their Symbols

(Note) Precautions for Part Replacement

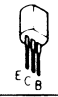
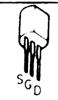
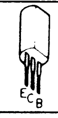
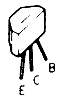
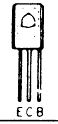
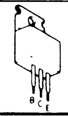
- In the schematic diagram, parts marked ⚠ (ex. ⚠ . F801) are critical parts to meet the safety regulations, so always use the parts bearing specified part codes (SN) when replacing them.
- Using the parts other than those specified shall violate the regulations, and may cause troubles such as operation failures, fire, etc.

1. IC's

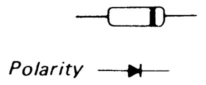
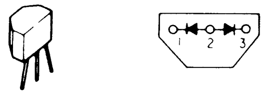
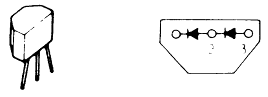
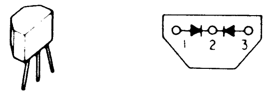
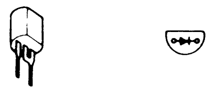
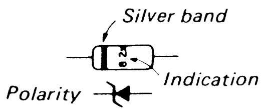
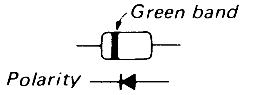
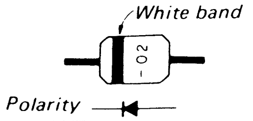
Name	Shape
CX20104	 48 25 TOP VIEW 1 24
CX7989, CX20097, CX20105, TA7788AP, TL8702P, TCP4633-9822X, TD6314P-01, TMP4315-0135X, TMP4320-6358Y, TMP4320-6391Y, TMP4320-6445Y, TMP4320-6448Y, TD6314P-05, TMP4320-6457Y, TMP4320-6454Y, TMP4320-6451Y, TCP6433-9831X, CX2012, TCP4320-6455Y	 42 22 TOP VIEW 1 21
TA7744P	 30 16 TOP VIEW 1 15
CX20026	 28 15 TOP VIEW 1 14
TA7743P, BA668A	 18 10 TOP VIEW 1 9
LA1231N, TA7607AP, TA7740P, TA7742P, TC4028BP, TC4051BP, TC4052BP, TC4053BP, TC4538BP, TC5067BP, TC74HC42P, TD62504P, TL8610P, SN7442AN, TC4015PB, TA7745P, CXA1011P, TC4512BP	 16 9 TOP VIEW 1 8
CX7982, TC4013BP, TC4030BP, TA75902P, TA7741P, TC4001BP, TC4066BP, TA75339P	 14 8 TOP VIEW 1 7
TA7328AP	 FRONT VIEW 1 12
BA6138, TA7325P, TA7337P, TA7339P, TA7348P, TA7351P, TA7365P, TA75393S, TA75458S, µPC1474HA	 FRONT VIEW 1 9

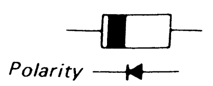
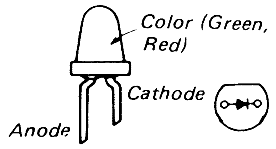
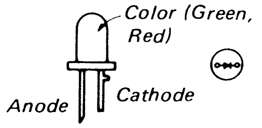
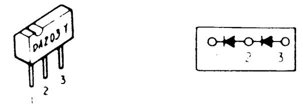
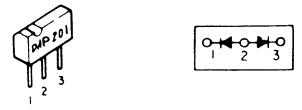
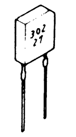
Name	Shape
TA7267P	
BA222, TA7140P, TA7347P, TA7361P, TA7302P	 FRONT VIEW 1 7
TA7277AP, TA7277BP	
STK7221	 STK7221 VOLTAGE REG
M51643L	 FRONT VIEW 1 24
AN6366NK	
LA7090	
MN6163A	
TM4746-5760	 64 33 TOP VIEW 1 32
BA6209	
14VT06A	 FRONT VIEW 14
HK-001A	 FRONT VIEW 19
PST520C	

2. Transistors

Name	Shape
2SA562RM-Y, 2SCA1015Y, 2SC1815-Y, 2SC1923-O, 2SC1923, 2SC1959-Y, 2SC2878-A, 2SC2878-B, 2SC388ATH	
2SK30ATH-R, 2SK30ATH-Y, 2SK30ATM-GR	
2SA966-Y, 2SA1020-Y, 2SC2236-Y, 2SC2655-Y	
2SA1048-Y, 2SC2458-GR, 2SC2458-Y, 2SC2458-BL, RN1201, RN1202, RN1203, RN1204, RN1205, RN1206, RN2201, RN2202, RN2203, RN2204, RN2205, RN2206	
2SD549	
2SA968-Y, 2SB435-Y, 2SD686, 2SD880-Y, 2SB834-O, 2SD553-Y, 2SD235-GR	

3. Diodes

Name	Shape
1S1553, 1S1554 (TV), 1S1555 (TV), 1S2236	
1SS200	
1SS227	
1SS201	
µPC574J	
05Z2.2-Z, 05Z3.6-Z, 05Z3.9-X, 05Z3.9-Y, 05Z5.1-X, 05Z5.1-Z, 05Z5.6-Y, 05Z6.2-Z, 05Z6.8Y, 05Z7.5-Y 05Z8.2-X, 05Z9.1-X, 05Z9.1-Y, 05Z10-Y, 05Z11-Y, 05Z12-Z, 05Z15-Z, 05Z8.2-Y, 05Z2.7-Y, 05Z12-Y, 05Z5.6-Z	 Silver band Indication Polarity
1SS176	 Green band Polarity
ERC01-02FL	 White band Polarity

Name	Shape
ERA12-02 (White band) S1S3M (Red band)	
TLUG163 TLUR163 TLUR164	 Color (Green, Red) Cathode Anode
TLG113A TLR113AD	 Color (Green, Red) Anode Cathode
DA203	
DAP201	
PH302	

4. Solid resistor indication

Resistor	1/8W film	P type film	U type film	Solid	Oxide film	Metal film	Cement	Fuse
Symbol	None	P	U	S	R	W	W	RF

Tolerance	±2%	±5%	±10%	±20%
Symbol	G	J	None	None

- All film type and oxide film type resistors used are ±5%, so the tolerance symbol was not indicated for them.

5. Capacitor indication

Description	Symbol	Capacitance, unit	Capacitance allowance
Electrolytic	⁺⊣⊢	µF	Not indicated
Special electrolytic			Indicated
Plastic film	⊣⊢	µF: indicated with numbers below decimal point	Indicated below ±5% (J), indicated below ±0.5 PF, not indicated for others
Ceramic		PF: indicated with numbers over decimal point	
Trimmer	⊣⊬	PF	Not indicated

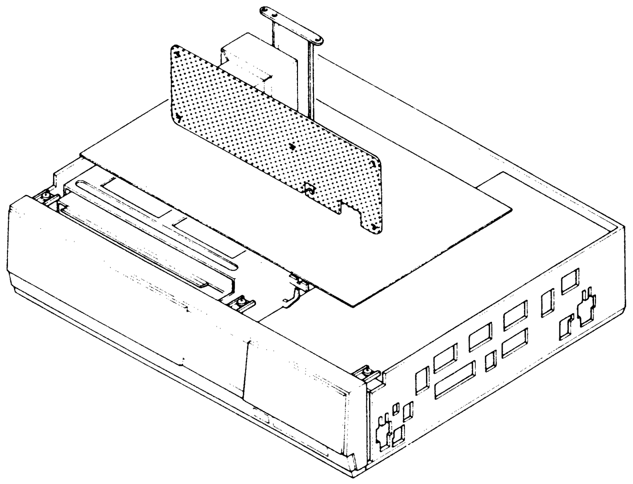
(Note) No working voltage is indicated for capacitors rated at 50V except electrolytic capacitors.

6. Waveform and voltage measurement

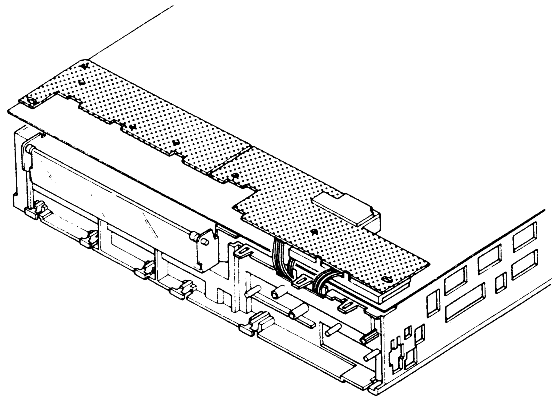
- Measurement of waveform and voltage at each section in the color circuits was conducted with sufficient service color bar signal being received and reproduced in normal conditions.
- Waveforms and voltage values for the remaining circuit were measured with a broadcasting signal normally received, so they may vary slightly according to the programs being received. Use them as a measure for servicing.
- All voltage values except the waveforms are expressed in DC and measured by a digital voltmeter.

6. Standing PC Boards for Servicing

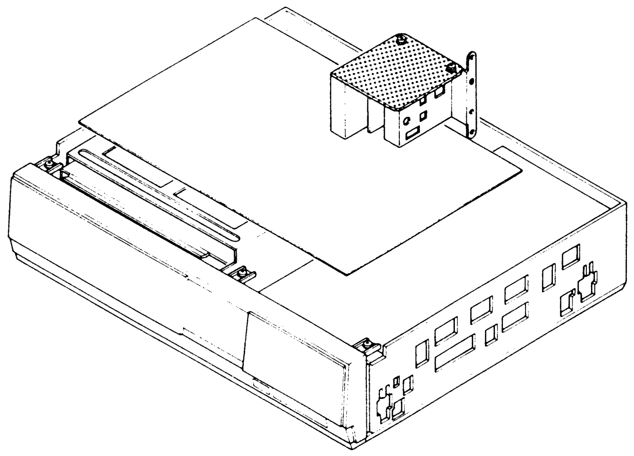
Power Supply PC Board



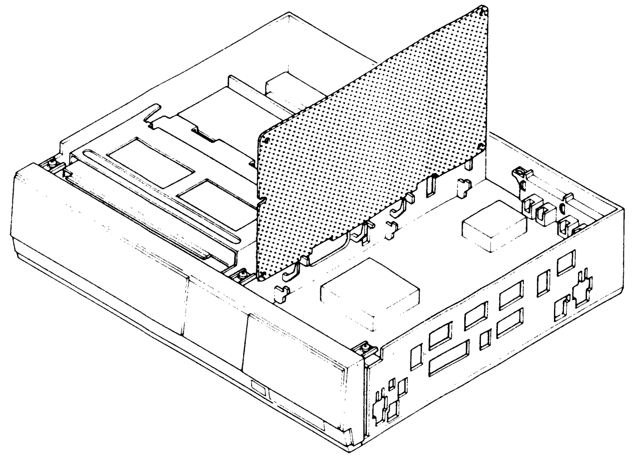
Logic Switch, Timer PC Board



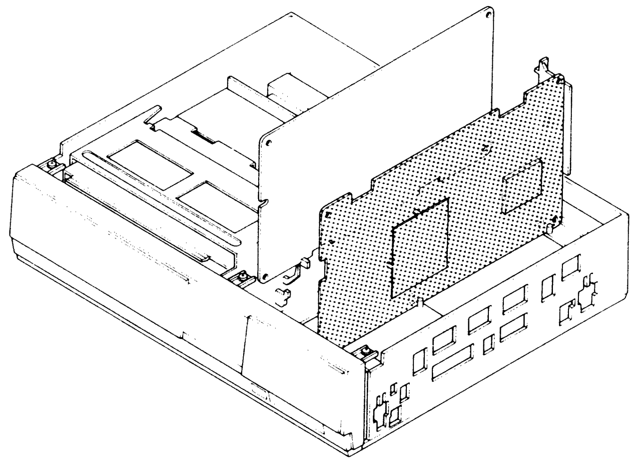
PIF PC Board



Control PC Board
(Servo, Logic, Power 2, Channel Selector)



Video, Audio PC Board



NOTE: Chip Part Replacement (Use spare parts with wire leads connected.)

1. Hold a Chip part to be replaced with tweezers and apply heat to a soldered place at an end of the part with a soldering iron. (Fig. 6-1)
2. Apply heat to a soldered place at another end of the part sucessively and remove the part.
   The heating time should be as short as possible so that excessive heat is not applied to foil patterns and the P.C. Board.
3. If it is failured to remove the part, temporarily stop the desoldering job and wait until temperature of the part lowers.
   Then, repeat the steps 1 and 2.
4. From leads of a replacement part (general part equivalent to the chip part) as shown below and apply preliminary soldering to the leads. (Fig. 6-2)
5. Mount the part so that it does not touch any other parts. (Fig. 6-3)

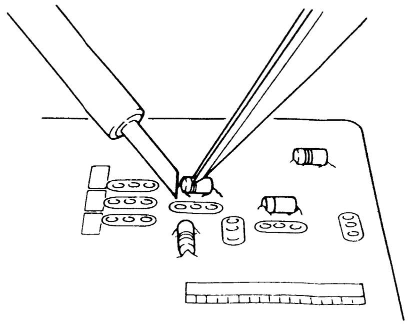


Fig. 6-1

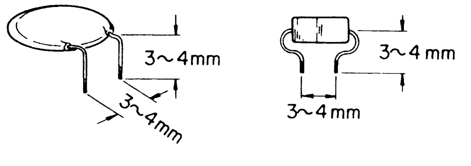


Fig. 6-2

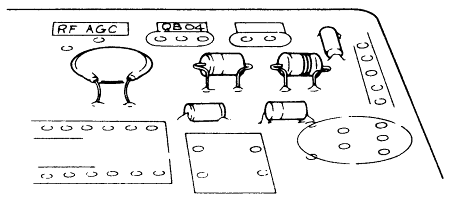
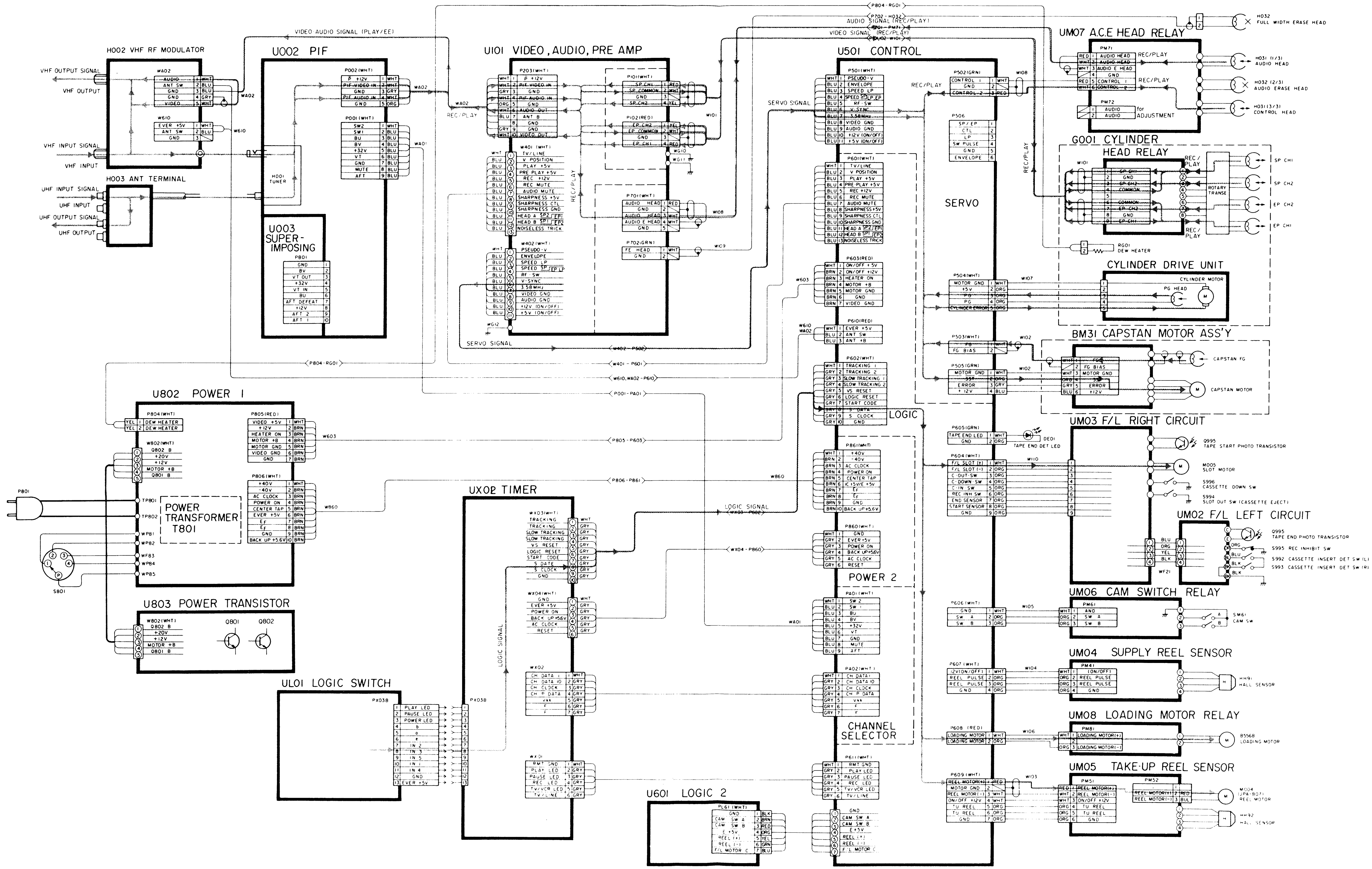
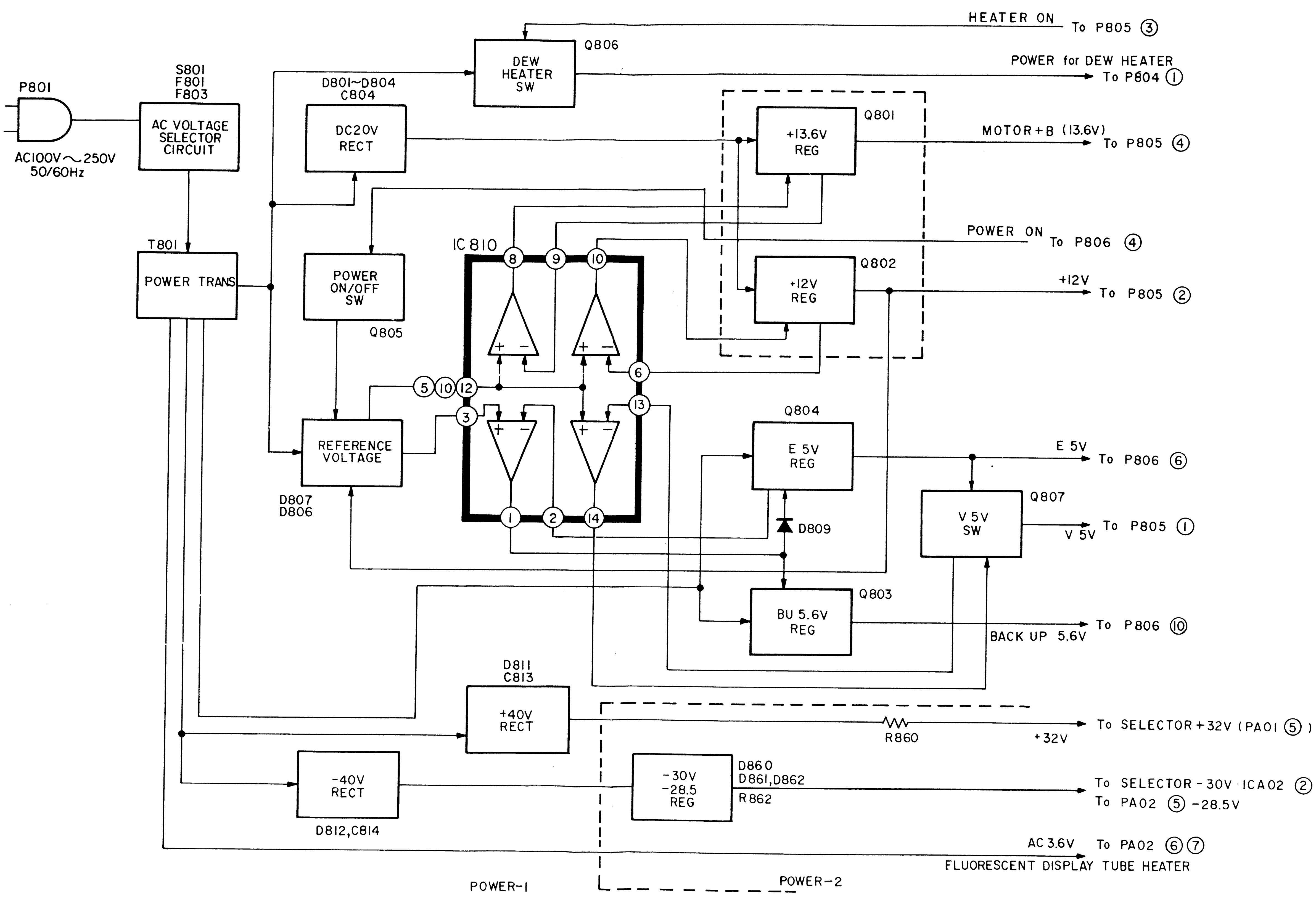


Fig. 6-3

7. Printed Wiring Board and Schematic Diagram


H002 VHF RF MODULATOR
VHF OUTPUT SIGNAL
VHF OUTPUT
VHF INPUT SIGNAL
VHF INPUT
H003 ANT TERMINAL
UHF INPUT SIGNAL
UHF INPUT
UHF OUTPUT SIGNAL
UHF OUTPUT
H001 TUNER
U002 PIF
U003 SUPER-IMPOSING
U101 VIDEO, AUDIO, PRE AMP
U501 CONTROL
SERVO
LOGIC
POWER 2
CHANNEL SELECTOR
VIDEO AUDIO SIGNAL (PLAY/EE)
AUDIO SIGNAL (REC/PLAY)
VIDEO SIGNAL (REC/PLAY)
SERVO SIGNAL
LOGIC SIGNAL
REC/PLAY
UM07 A.C.E HEAD RELAY
H032 FULL WIDTH ERASE HEAD
H031 (1/3) AUDIO HEAD
H032 (2/3) AUDIO ERASE HEAD
H031 (3/3) CONTROL HEAD
for ADJUSTMENT
G001 CYLINDER HEAD RELAY
ROTARY TRANSE
SP CH1
SP CH2
EP CH2
EP CH1
RG01 DEW HEATER
CYLINDER DRIVE UNIT
CYLINDER MOTOR
PG HEAD
BM31 CAPSTAN MOTOR ASS'Y
CAPSTAN FG
CAPSTAN MOTOR
UM03 F/L RIGHT CIRCUIT
DE01 TAPE END DET LED
D995 TAPE START PHOTO TRANSISTOR
M005 SLOT MOTOR
S996 CASSETTE DOWN SW
S994 SLOT OUT SW (CASSETTE EJECT)
UM02 F/L LEFT CIRCUIT
Q995 TAPE END PHOTO TRANSISTOR
S995 REC INHIBIT SW
S992 CASSETTE INSERT DET SW (L)
S993 CASSETTE INSERT DET SW (R)
UM06 CAM SWITCH RELAY
SM61 CAM SW
UM04 SUPPLY REEL SENSOR
HH91 HALL SENSOR
UM08 LOADING MOTOR RELAY
B5568 LOADING MOTOR
UM05 TAKE-UP REEL SENSOR
M004 (JPA-807) REEL MOTOR
HH92 HALL SENSOR
U601 LOGIC 2
UX02 TIMER
UL01 LOGIC SWITCH
U802 POWER 1
POWER TRANSFORMER T801
P801
S801
U803 POWER TRANSISTOR
Q801
Q802

8-1. Power Supply Block Diagram


HEATER ON
To P805 ③
Q806
DEW HEATER SW
POWER for DEW HEATER
To P804 ①
P801
S801
F801
F803
AC VOLTAGE SELECTOR CIRCUIT
AC100V～250V
50/60Hz
D801～D804
C804
DC20V RECT
Q801
+13.6V REG
MOTOR+B (13.6V)
To P805 ④
POWER ON
To P806 ④
T801
POWER TRANS
POWER ON/OFF SW
Q805
IC810
⑧
⑨
⑩
Q802
+12V REG
+12V
To P805 ②
⑤⑩⑫
③
⑥
⑬
REFERENCE VOLTAGE
D807
D806
①
②
⑭
Q804
E 5V REG
E 5V
To P806 ⑥
D809
Q807
V 5V SW
V 5V
To P805 ①
Q803
BU 5.6V REG
To P806 ⑩
BACK UP 5.6V
D811
C813
+40V RECT
R860
+32V
To SELECTOR +32V (PA01 ⑤)
-40V RECT
D812,C814
-30V
-28.5
REG
D860
D861,D862
R862
To SELECTOR -30V ICA02 ②
To PA02 ⑤ -28.5V
AC 3.6V
To PA02 ⑥⑦
FLUORESCENT DISPLAY TUBE HEATER
POWER-1
POWER-2

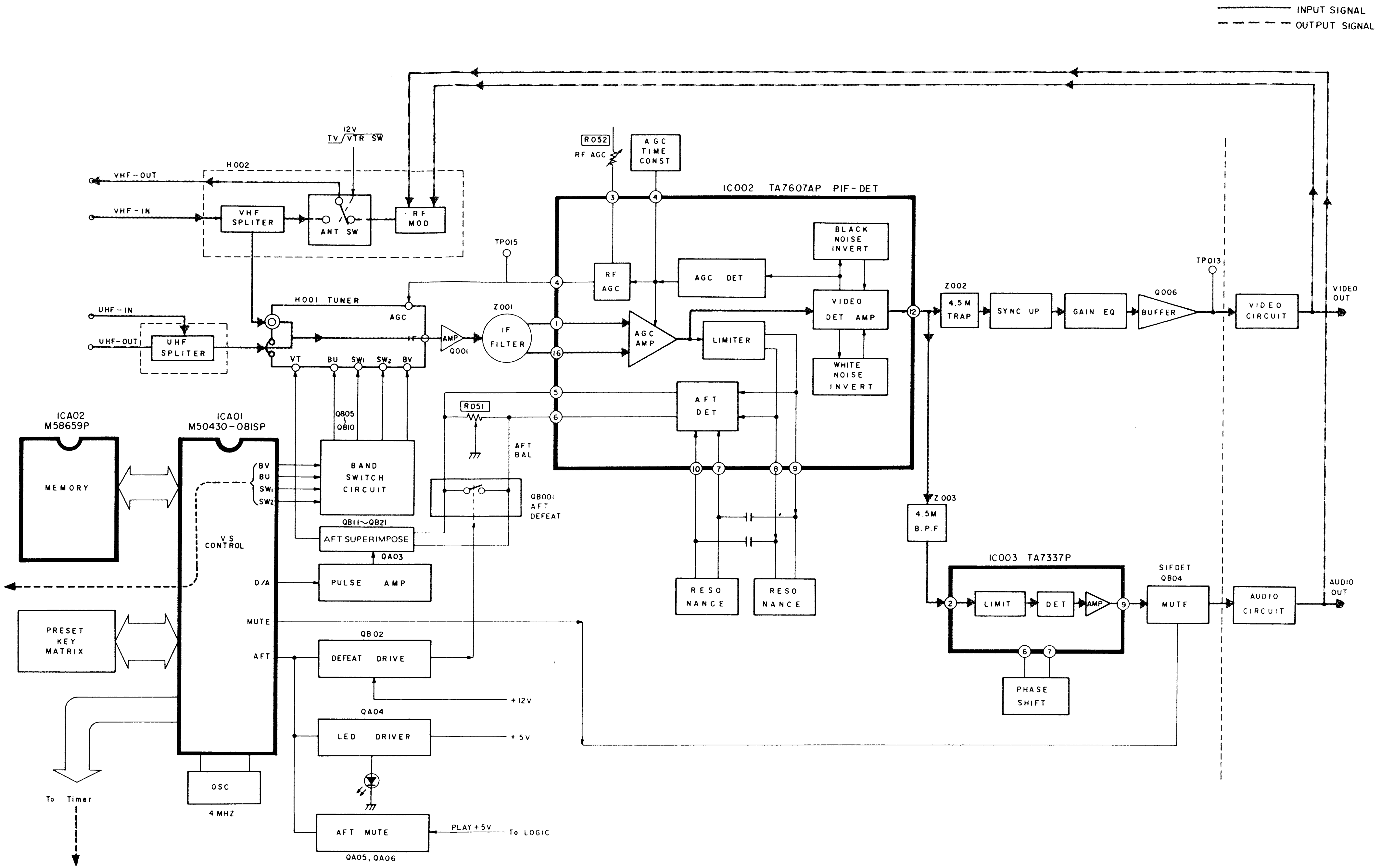
9-1. PIF Block Diagram

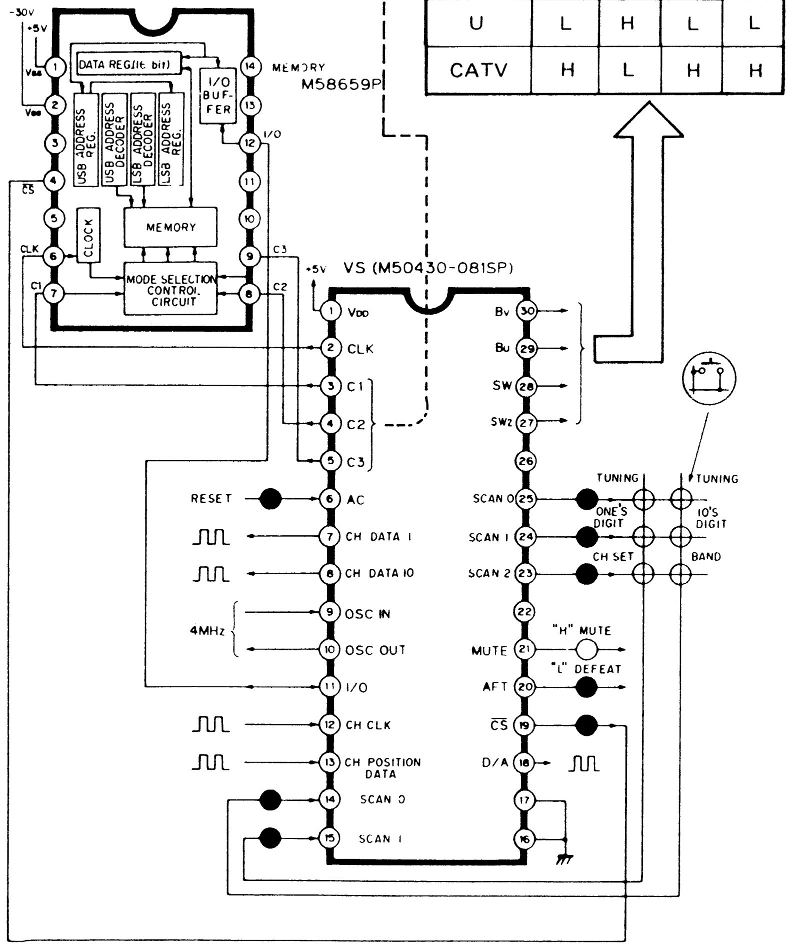
Memory's Reading & Writing Polarities

Terminal / Operation Mode	C_1	C_2	C_3
Standby	H	H	H
Erase	H	L	H
Address input	H	L	L
Reading	L	H	H
Data output	L	H	L
Writing	L	L	H
Data input	L	L	L

Band Data

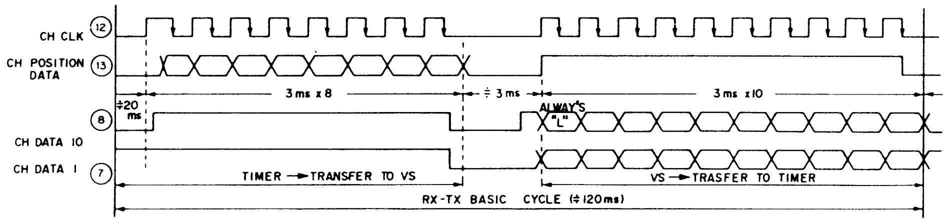
μcomp. Terminal / Band	Bv	Bu	SW	SW_2
VL	H	L	L	L
VH	H	L	H	L
U	L	H	L	L
CATV	H	L	H	H


INPUT SIGNAL
OUTPUT SIGNAL
12V
TV / VTR SW
H002
VHF-OUT
VHF-IN
VHF SPLITER
ANT SW
RF MOD
UHF-IN
UHF-OUT
UHF SPLITER
H001 TUNER
AGC
IF
VT
BU
SW1
SW2
BV
AMP
Q001
Z001
IF FILTER
TP015
R052
RF AGC
AGC TIME CONST
IC002 TA7607AP PIF-DET
RF AGC
AGC DET
BLACK NOISE INVERT
AGC AMP
VIDEO DET AMP
LIMITER
WHITE NOISE INVERT
AFT DET
RESO NANCE
RESO NANCE
R051
AFT BAL
QB001 AFT DEFEAT
Z002
4.5M TRAP
SYNC UP
GAIN EQ
Q006
BUFFER
TP013
VIDEO CIRCUIT
VIDEO OUT
Z 003
4.5M B.P.F
IC003 TA7337P
LIMIT
DET
AMP
PHASE SHIFT
SIFDET QB04
MUTE
AUDIO CIRCUIT
AUDIO OUT
ICA02 M58659P
MEMORY
ICA01 M50430-081SP
VS CONTROL
D/A
MUTE
AFT
PRESET KEY MATRIX
OSC
4 MHZ
Q805 ~ Q810
BAND SWITCH CIRCUIT
QB11~QB21
AFT SUPERIMPOSE
QA03
PULSE AMP
QB02
DEFEAT DRIVE
+12V
QA04
LED DRIVER
+5V
AFT MUTE
QA05, QA06
PLAY +5V
To LOGIC
To Timer

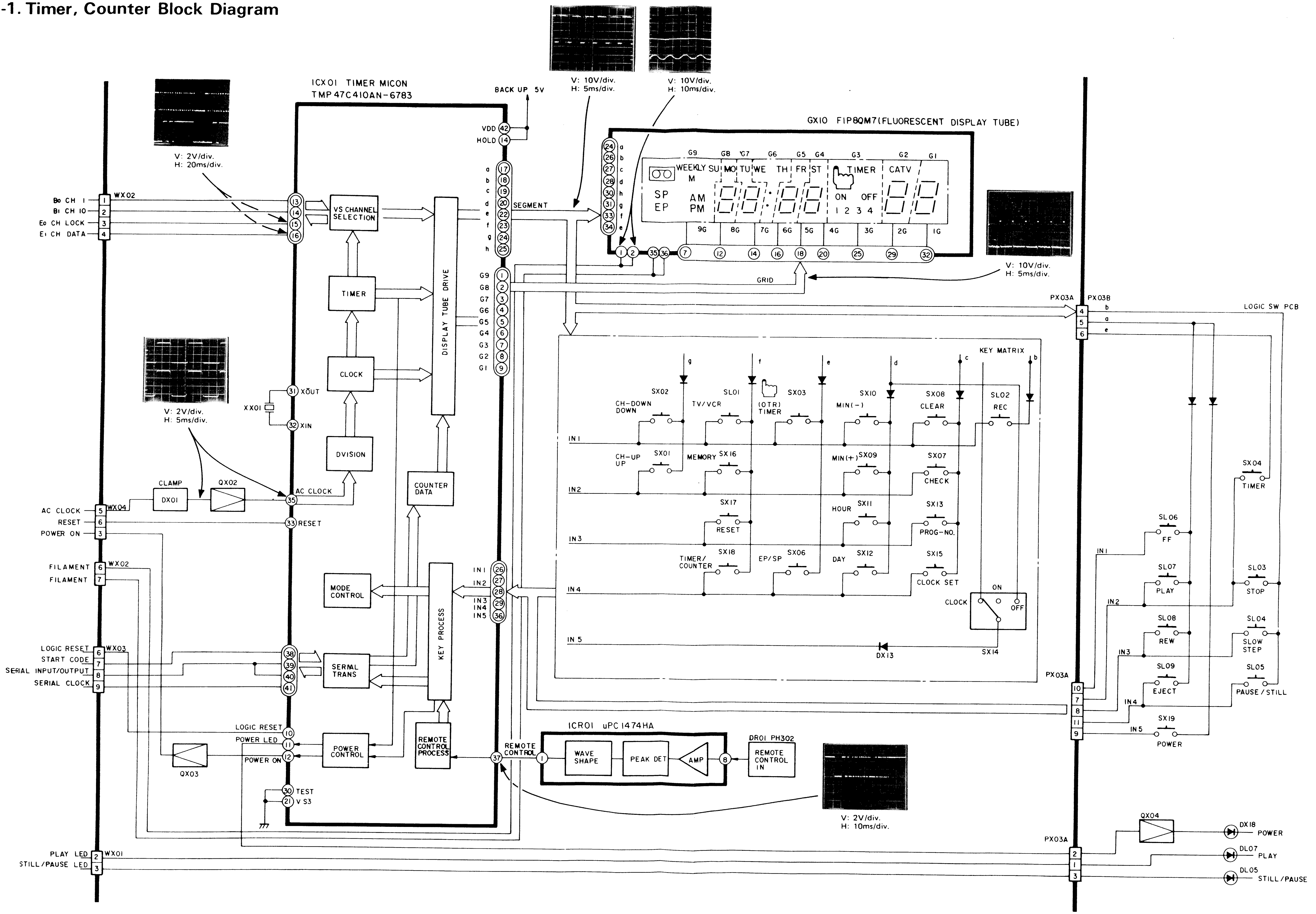

-30V
+5V
Vss
Vss
CS
CLK
C1
DATA REG(16 bit)
I/O BUFFER
USB ADDRESS REG.
USB ADDRESS DECODER
LSB ADDRESS DECODER
LSB ADDRESS REG.
CLOCK
MEMORY
MODE SELECTION CONTROL CIRCUIT
MEMORY M58659P
I/O
C3
C2
+5V
VS (M50430-081SP)
VDD
CLK
C1
C2
C3
AC
CH DATA 1
CH DATA 10
OSC IN
OSC OUT
I/O
CH CLK
CH POSITION DATA
SCAN 0
SCAN 1
RESET
4MHz
Bv
Bu
SW
SW2
SCAN 0
SCAN 1
SCAN 2
MUTE
AFT
CS
D/A
TUNING
ONE'S DIGIT
TUNING
10'S DIGIT
CH SET
BAND
"H" MUTE
"L" DEFEAT

Serial Transfer

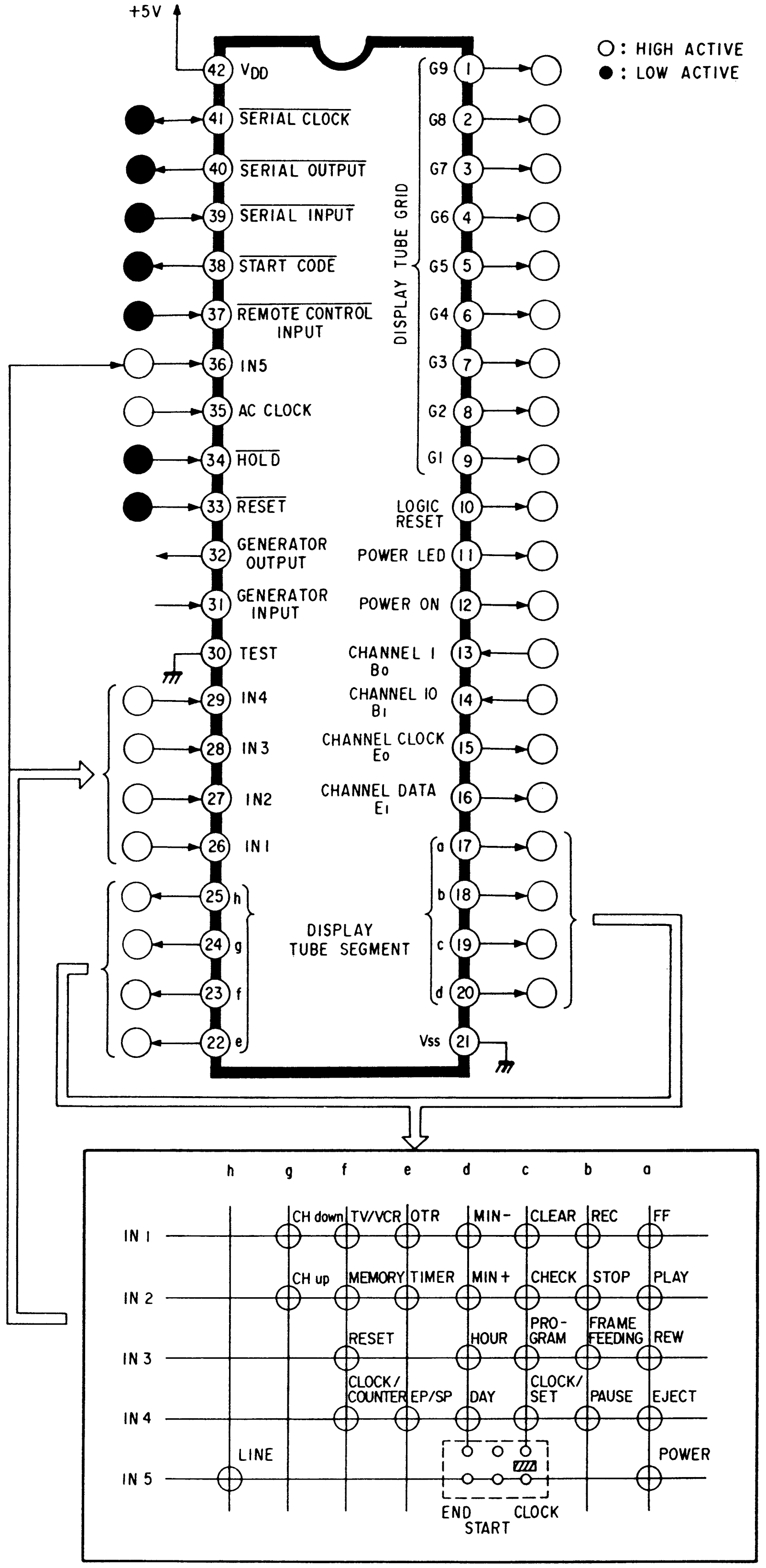
Direction	Serial Transfer Information		Bit
Timer ↓ Vs	CH position data		4
	Tuning output enable		1
	Preset inhibit		1
	Power ON		1
	Direct/Up-down		1
Vs ↓ Timer	Real CH data	One's digit	4
		Ten's digit	4
	CH position data		4
	Band data		2
	Preset data		1
	Tuning voltage data		3

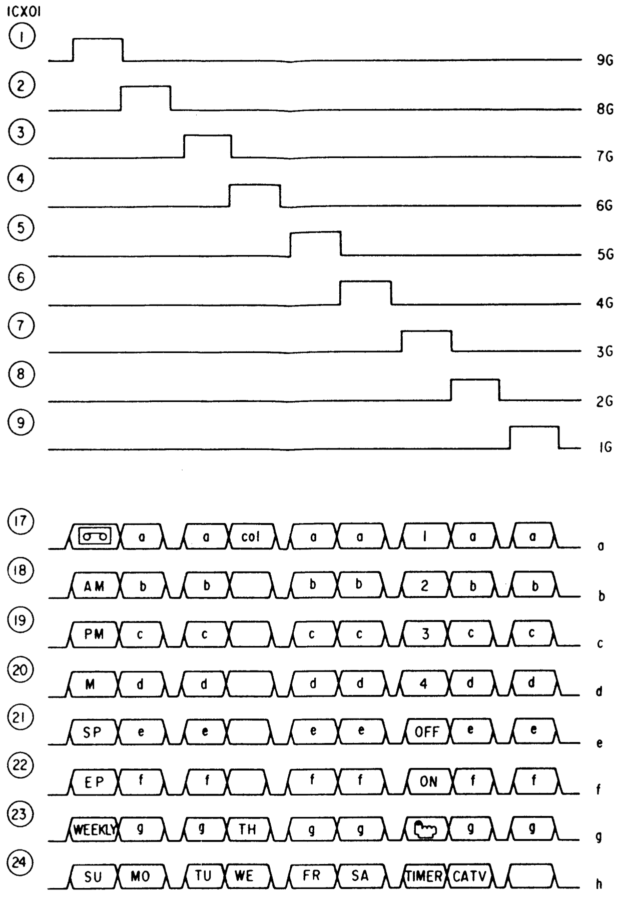

CH CLK ⑫
CH POSITION DATA ⑬
⑧
CH DATA 10
CH DATA 1 ⑦
÷20 ms
3ms x 8
÷ 3ms
3ms x10
ALWAYS "L"
TIMER → TRANSFER TO VS
VS → TRASFER TO TIMER
RX-TX BASIC CYCLE (÷120ms)

10-1. Timer, Counter Block Diagram

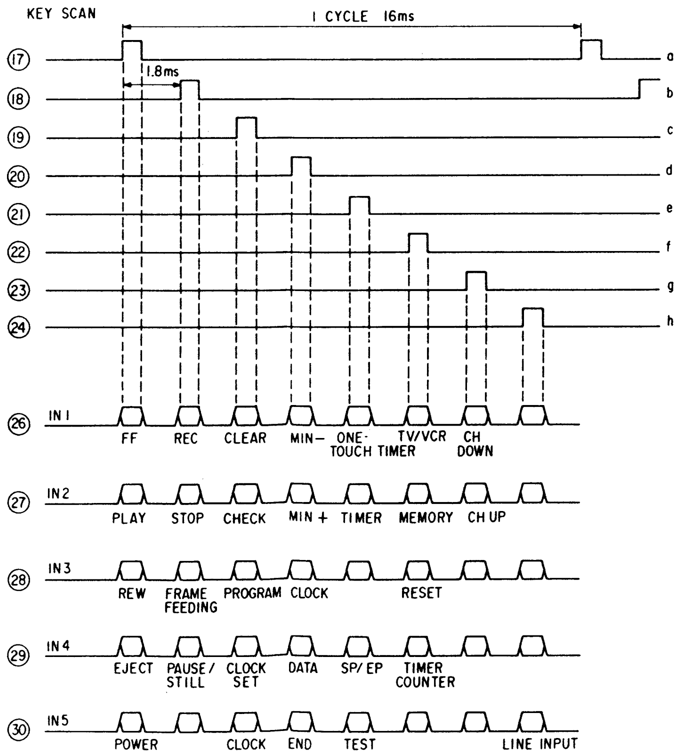

ICX01 TIMER MICON
TMP47C410AN-6783
BACK UP 5V
VDD 42
HOLD 14
V: 2V/div.
H: 20ms/div.
V: 10V/div.
H: 5ms/div.
V: 10V/div.
H: 10ms/div.
V: 10V/div.
H: 5ms/div.
V: 2V/div.
H: 5ms/div.
V: 2V/div.
H: 10ms/div.
WX02
B0 CH 1
B1 CH 10
E0 CH LOCK
E1 CH DATA
VS CHANNEL SELECTION
TIMER
CLOCK
DVISION
DISPLAY TUBE DRIVE
COUNTER DATA
KEY PROCESS
MODE CONTROL
SERIAL TRANS
POWER CONTROL
REMOTE CONTROL PROCESS
XX01
XOUT
XIN
CLAMP
DX01
QX02
AC CLOCK
WX04
AC CLOCK
RESET
POWER ON
FILAMENT
FILAMENT
WX03
LOGIC RESET
START CODE
SERIAL INPUT/OUTPUT
SERIAL CLOCK
LOGIC RESET
POWER LED
POWER ON
QX03
TEST
V S3
WX01
PLAY LED
STILL/PAUSE LED
SEGMENT
GRID
GX10 FIP8QM7(FLUORESCENT DISPLAY TUBE)
G9 G8 G7 G6 G5 G4 G3 G2 G1
WEEKLY SU MO TU WE TH FR ST
M
SP EP
AM PM
TIMER
CATV
ON OFF
1 2 3 4
9G 8G 7G 6G 5G 4G 3G 2G 1G
IN1 IN2 IN3 IN4 IN5
REMOTE CONTROL
ICR01 uPC1474HA
WAVE SHAPE
PEAK DET
AMP
DR01 PH302
REMOTE CONTROL IN
KEY MATRIX
SX02 CH-DOWN DOWN
SL01 TV/VCR
SX03 (OTR) TIMER
SX10 MIN(−)
SX08 CLEAR
SL02 REC
SX01 CH-UP UP
SX16 MEMORY
SX09 MIN(+)
SX07 CHECK
SX17 RESET
SX11 HOUR
SX13 PROG-NO.
SX18 TIMER/COUNTER
SX06 EP/SP
SX12 DAY
SX15 CLOCK SET
CLOCK ON OFF
SX14
DX13
PX03A
PX03B
LOGIC SW PCB
SX04 TIMER
SL06 FF
SL07 PLAY
SL03 STOP
SL08 REW
SL04 SLOW STEP
SL09 EJECT
SL05 PAUSE/STILL
SX19 POWER
QX04
DX18 POWER
DL07 PLAY
DL05 STILL/PAUSE

ICX01 TMP 47C410AN-6784
TIMER MICROCOMPUTER

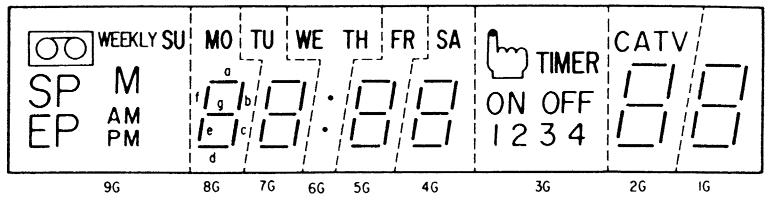

+5V
○ : HIGH ACTIVE
● : LOW ACTIVE
42 VDD
41 SERIAL CLOCK
40 SERIAL OUTPUT
39 SERIAL INPUT
38 START CODE
37 REMOTE CONTROL INPUT
36 IN5
35 AC CLOCK
34 HOLD
33 RESET
32 GENERATOR OUTPUT
31 GENERATOR INPUT
30 TEST
29 IN4
28 IN3
27 IN2
26 IN1
25 h
24 g
23 f
22 e
DISPLAY TUBE SEGMENT
DISPLAY TUBE GRID
G9 1
G8 2
G7 3
G6 4
G5 5
G4 6
G3 7
G2 8
G1 9
LOGIC RESET 10
POWER LED 11
POWER ON 12
CHANNEL 1 B0 13
CHANNEL 10 B1 14
CHANNEL CLOCK E0 15
CHANNEL DATA E1 16
a 17
b 18
c 19
d 20
Vss 21
h g f e d c b a
IN 1
IN 2
IN 3
IN 4
IN 5
CH down
TV/VCR
OTR
MIN-
CLEAR
REC
FF
CH up
MEMORY
TIMER
MIN+
CHECK
STOP
PLAY
RESET
HOUR
PRO-GRAM
FRAME FEEDING
REW
CLOCK/COUNTER
EP/SP
DAY
CLOCK/SET
PAUSE
EJECT
LINE
POWER
END
START
CLOCK


ICX01
1 2 3 4 5 6 7 8 9
9G 8G 7G 6G 5G 4G 3G 2G 1G
17 18 19 20 21 22 23 24
a b c d e f g h
col
AM
PM
M
SP
EP
WEEKLY
SU MO TU WE FR SA TIMER CATV
TH
1 2 3 4 OFF ON

* The time chart shows outputs for the display tube only and outputs for the key scanning are omitted.

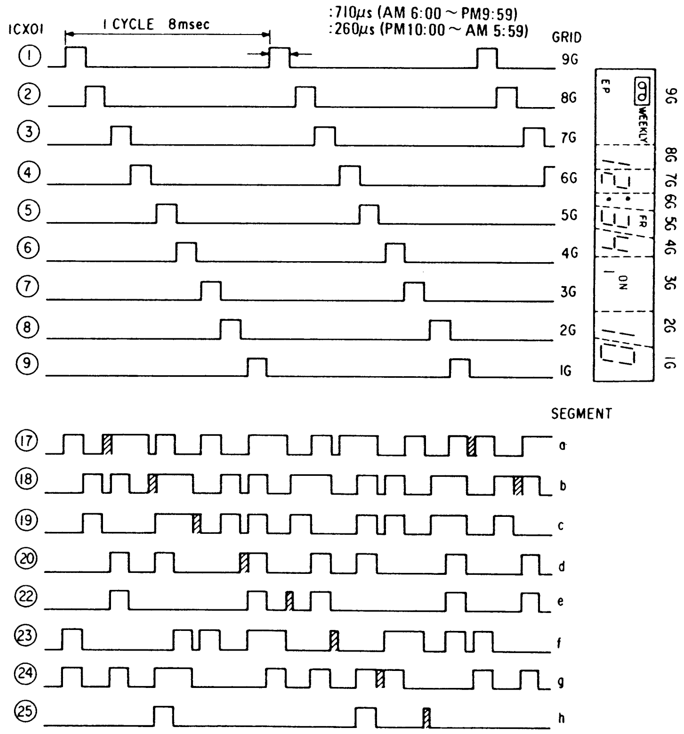

KEY SCAN
1 CYCLE 16ms
1.8ms
17 18 19 20 21 22 23 24
a b c d e f g h
26 IN1
FF REC CLEAR MIN− ONE-TOUCH TIMER TV/VCR CH DOWN
27 IN2
PLAY STOP CHECK MIN+ TIMER MEMORY CH UP
28 IN3
REW FRAME FEEDING PROGRAM CLOCK RESET
29 IN4
EJECT PAUSE/STILL CLOCK SET DATA SP/EP TIMER COUNTER
30 IN5
POWER CLOCK END TEST LINE INPUT

* The time chart shows outputs for the key scanning only and outputs for the display tube only are omitted.


WEEKLY SU MO TU WE TH FR SA
TIMER
CATV
SP M
EP AM PM
ON OFF
1 2 3 4
a b c d e g
9G 8G 7G 6G 5G 4G 3G 2G 1G

Display Pattern

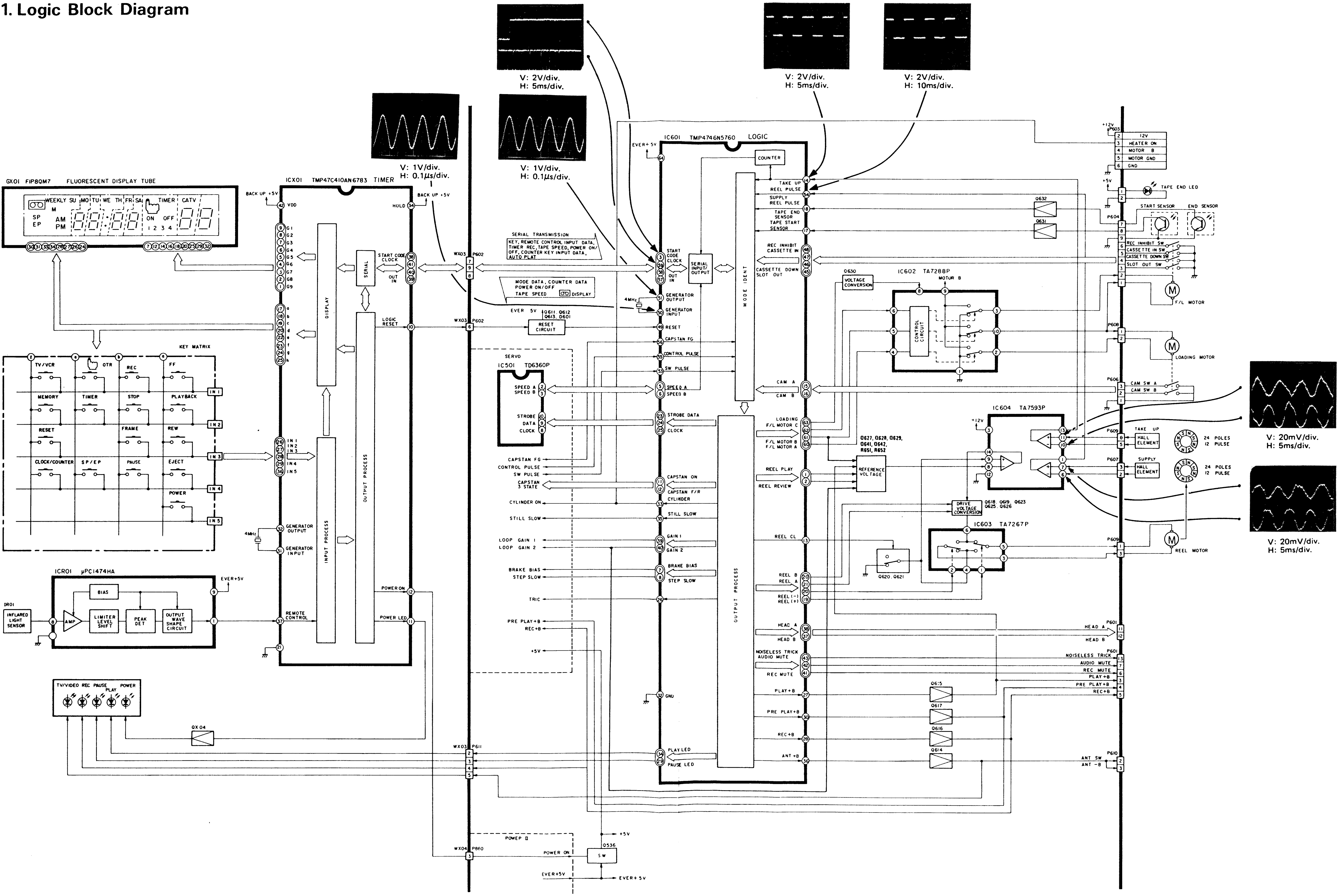
Grid / Seg	G1	G2	G3	G4	G5	G6	G7	G8	G9
a	a	a	1	a	a	colon	a	a	📼
b	b	b	2	b	b		b	b	AM
c	c	c	3	c	c		c	c	PM
d	d	d	4	d	d		d	d	MEM-ORY
e	e	e	END (OFF)	e	e		e	e	SP
f	f	f	START (ON)	f	f		f	f	EP
g	g	g	☞	g	g	THU (TH)	g	g	EVERY WEEK
h		CATV	TIMER	SAT (SA)	FRI (FR)	WED (WE)	TUE (TU)	MON (MO)	SUN (SU)

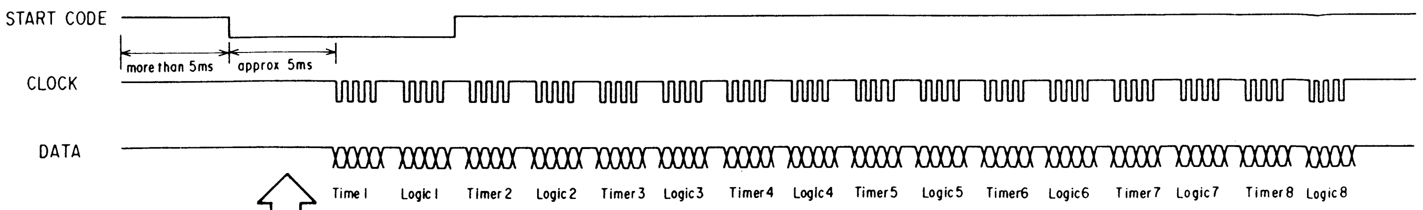

ICX01
1 CYCLE 8msec
:710µs (AM 6:00 ~ PM9:59)
:260µs (PM10:00 ~ AM 5:59)
GRID
1 2 3 4 5 6 7 8 9
9G 8G 7G 6G 5G 4G 3G 2G 1G
SEGMENT
17 18 19 20 22 23 24 25
a b c d e f g h

Display tube timing chart (Ex. 12:34 10ch)

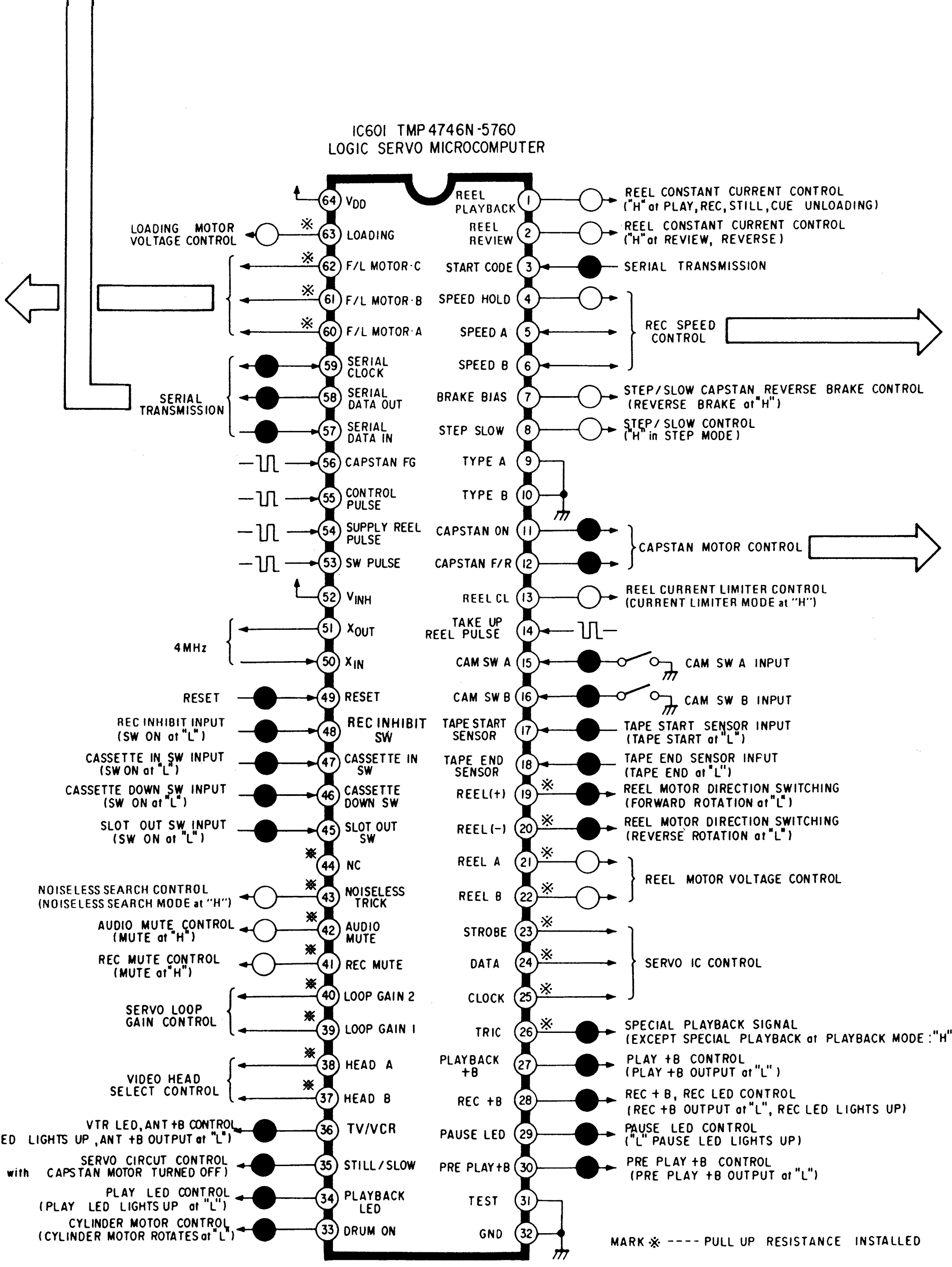
* Stands for output for key scanning and is developed at every two grid outputs.

11-1. Logic Block Diagram


V: 2V/div.
H: 5ms/div.
V: 2V/div.
H: 5ms/div.
V: 2V/div.
H: 10ms/div.
V: 1V/div.
H: 0.1μs/div.
V: 1V/div.
H: 0.1μs/div.
V: 20mV/div.
H: 5ms/div.
V: 20mV/div.
H: 5ms/div.
GX01 FIP8QM7 FLUORESCENT DISPLAY TUBE
WEEKLY SU MO TU WE TH FR SA TIMER CATV
SP
EP
M
AM
PM
ON OFF
1 2 3 4
ICX01 TMP47C410AN6783 TIMER
BACK UP +5V
VDD
HOLD
DISPLAY
SERIAL
START CODE CLOCK
OUT
IN
LOGIC RESET
INPUT PROCESS
OUTPUT PROCESS
GENERATOR OUTPUT
GENERATOR INPUT
4MHz
REMOTE CONTROL
POWER ON
POWER LED
KEY MATRIX
TV/VCR
OTR
REC
FF
MEMORY
TIMER
STOP
PLAYBACK
RESET
FRAME
REW
CLOCK/COUNTER
SP/EP
PAUSE
EJECT
POWER
IN 1
IN 2
IN 3
IN 4
IN 5
ICR01 μPC1474HA
EVER+5V
BIAS
AMP
LIMITER LEVEL SHIFT
PEAK DET
OUTPUT WAVE SHAPE CIRCUIT
DR01
INFLARED LIGHT SENSOR
TV/VIDEO REC PAUSE PLAY POWER
QX04
WX03 P602
WX03 P611
WX04 P8E0
SERIAL TRANSMISSION
KEY, REMOTE CONTROL INPUT DATA, TIMER REC, TAPE SPEED, POWER ON/OFF, COUNTER KEY INPUT DATA, AUTO PLAT
MODE DATA, COUNTER DATA
POWER ON/OFF
TAPE SPEED DISPLAY
EVER 5V
Q611 Q612
Q613 Q601
RESET CIRCUIT
SERVO
IC501 TD6360P
SPEED A
SPEED B
STROBE
DATA
CLOCK
CAPSTAN FG
CONTROL PULSE
SW PULSE
CAPSTAN 3 STATE
CYLINDER ON
STILL SLOW
LOOP GAIN 1
LOOP GAIN 2
BRAKE BIAS
STEP SLOW
TRIC
PRE PLAY+B
REC+B
+5V
POWER II
POWER ON
Q536
SW
EVER+5V
IC601 TMP4746N5760 LOGIC
EVER+5V
COUNTER
MODE IDENT
SERIAL INPUT/OUTPUT
START CODE CLOCK
OUT
IN
GENERATOR OUTPUT
GENERATOR INPUT
RESET
CAPSTAN FG
CONTROL PULSE
SW PULSE
SPEED A
SPEED B
STROBE DATA
CLOCK
CAPSTAN ON
CAPSTAN F/R
CYLINDER
STILL SLOW
GAIN 1
GAIN 2
BRAKE BIAS
STEP SLOW
GND
PLAY LED
PAUSE LED
OUTPUT PROCESS
TAKE UP REEL PULSE
SUPPLY REEL PULSE
TAPE END SENSOR
TAPE START SENSOR
REC INHIBIT
CASSETTE IN
CASSETTE DOWN
SLOT OUT
CAM A
CAM B
LOADING F/L MOTOR C
F/L MOTOR B
F/L MOTOR A
REEL PLAY
REEL REVIEW
REEL CL
REEL B
REEL A
REEL (−)
REEL (+)
HEAD A
HEAD B
NOISELESS TRICK AUDIO MUTE
REC MUTE
PLAY+B
PRE PLAY+B
REC+B
ANT+B
Q632
Q631
Q630
VOLTAGE CONVERSION
IC602 TA7288P
MOTOR B
CONTROL CIRCUIT
Q627, Q628, Q629, Q641, Q642, R651, R652
REFERENCE VOLTAGE
DRIVE VOLTAGE CONVERSION
Q618 Q619 Q623 Q625 Q626
IC604 TA7593P
+12V
IC603 TA7267P
Q620 Q621
Q615
Q617
Q616
Q614
P603
12V
HEATER ON
MOTOR B
MOTOR GND
GND
TAPE END LED
START SENSOR
END SENSOR
P604
REC INHIBIT SW
CASSETTE IN SW
CASSETTE DOWN SW
SLOT OUT SW
F/L MOTOR
P608
LOADING MOTOR
P606
CAM SW A
CAM SW B
P609
TAKE UP
HALL ELEMENT
24 POLES
12 PULSE
P607
SUPPLY
HALL ELEMENT
24 POLES
12 PULSE
REEL MOTOR
P601
HEAD A
HEAD B
NOISELESS TRICK
AUDIO MUTE
REC MUTE
PLAY+B
PRE PLAY+B
REC+B
P610
ANT SW
ANT −B


START CODE
CLOCK
DATA
more than 5ms
approx 5ms
Time I
Logic I
Timer2
Logic2
Timer3
Logic3
Timer4
Logic4
Timer5
Logic5
Timer6
Logic6
Timer7
Logic7
Timer8
Logic8

Mode \ F/L Motor	A	B	C
Stop	H	H	H
Slot-in	L	H	L
Slot-out	L	H	H
Loading	H	L	L
Unloading	H	L	H


IC601 TMP4746N-5760
LOGIC SERVO MICROCOMPUTER
64 VDD
63 LOADING
LOADING MOTOR VOLTAGE CONTROL
62 F/L MOTOR·C
61 F/L MOTOR·B
60 F/L MOTOR·A
59 SERIAL CLOCK
58 SERIAL DATA OUT
57 SERIAL DATA IN
SERIAL TRANSMISSION
56 CAPSTAN FG
55 CONTROL PULSE
54 SUPPLY REEL PULSE
53 SW PULSE
52 VINH
51 XOUT
50 XIN
4MHz
RESET
49 RESET
REC INHIBIT INPUT (SW ON at "L")
48 REC INHIBIT SW
CASSETTE IN SW INPUT (SW ON at "L")
47 CASSETTE IN SW
CASSETTE DOWN SW INPUT (SW ON at "L")
46 CASSETTE DOWN SW
SLOT OUT SW INPUT (SW ON at "L")
45 SLOT OUT SW
44 NC
NOISELESS SEARCH CONTROL (NOISELESS SEARCH MODE at "H")
43 NOISELESS TRICK
AUDIO MUTE CONTROL (MUTE at "H")
42 AUDIO MUTE
REC MUTE CONTROL (MUTE at "H")
41 REC MUTE
40 LOOP GAIN 2
39 LOOP GAIN I
SERVO LOOP GAIN CONTROL
38 HEAD A
37 HEAD B
VIDEO HEAD SELECT CONTROL
VTR LED, ANT +B CONTROL (VTR LED LIGHTS UP, ANT +B OUTPUT at "L")
36 TV/VCR
SERVO CIRCUT CONTROL ("L" with CAPSTAN MOTOR TURNED OFF)
35 STILL/SLOW
PLAY LED CONTROL (PLAY LED LIGHTS UP at "L")
34 PLAYBACK LED
CYLINDER MOTOR CONTROL (CYLINDER MOTOR ROTATES at "L")
33 DRUM ON
1 REEL PLAYBACK
REEL CONSTANT CURRENT CONTROL ("H" at PLAY, REC, STILL, CUE UNLOADING)
2 REEL REVIEW
REEL CONSTANT CURRENT CONTROL ("H" at REVIEW, REVERSE)
3 START CODE
SERIAL TRANSMISSION
4 SPEED HOLD
5 SPEED A
6 SPEED B
REC SPEED CONTROL
7 BRAKE BIAS
STEP/SLOW CAPSTAN REVERSE BRAKE CONTROL (REVERSE BRAKE at "H")
8 STEP SLOW
STEP/SLOW CONTROL ("H" in STEP MODE)
9 TYPE A
10 TYPE B
11 CAPSTAN ON
12 CAPSTAN F/R
CAPSTAN MOTOR CONTROL
13 REEL CL
REEL CURRENT LIMITER CONTROL (CURRENT LIMITER MODE at "H")
14 TAKE UP REEL PULSE
15 CAM SW A
CAM SW A INPUT
16 CAM SW B
CAM SW B INPUT
17 TAPE START SENSOR
TAPE START SENSOR INPUT (TAPE START at "L")
18 TAPE END SENSOR
TAPE END SENSOR INPUT (TAPE END at "L")
19 REEL(+)
REEL MOTOR DIRECTION SWITCHING (FORWARD ROTATION at "L")
20 REEL(–)
REEL MOTOR DIRECTION SWITCHING (REVERSE ROTATION at "L")
21 REEL A
22 REEL B
REEL MOTOR VOLTAGE CONTROL
23 STROBE
24 DATA
25 CLOCK
SERVO IC CONTROL
26 TRIC
SPECIAL PLAYBACK SIGNAL (EXCEPT SPECIAL PLAYBACK at PLAYBACK MODE :"H")
27 PLAYBACK +B
PLAY +B CONTROL (PLAY +B OUTPUT at "L")
28 REC +B
REC +B, REC LED CONTROL (REC +B OUTPUT at "L", REC LED LIGHTS UP)
29 PAUSE LED
PAUSE LED CONTROL ("L" PAUSE LED LIGHTS UP)
30 PRE PLAY+B
PRE PLAY +B CONTROL (PRE PLAY +B OUTPUT at "L")
31 TEST
32 GND
MARK ※ ---- PULL UP RESISTANCE INSTALLED

Mode \ Control Mode		Hold	Speed A	Speed B
PLAY CUE/REVIEW	SP	L	H	L
	LP	L	L	H
	EP	L	L	L
Other than above	SP	H	H	L
	EP	H	L	L

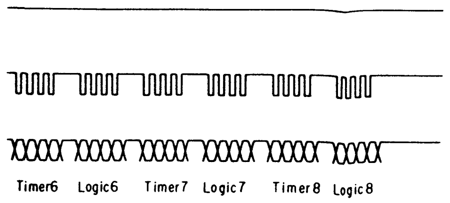
Capstan Motor	CAP ON	CAP F/R
Stop	H	H
Normal direction	L	H
Reverse direction	L	L

Period: 30ms

Direction	Data	
Timer → Logic	Power ON/OFF	Timer 2
	Key & remote control input	Timer 2·3
	Timer recording	Timer 2·3
	Auto PLAY mode	Timer 1
	Counter memory mode	Timer 1
	Counter reset	Timer 2·3
	TAPE speed	Timer 1
	TV/VCR	Timer 1
	Counter (back-up)	Timer 4 ～ 7
Logic → Timer	Mode data	Logic 2·3
	Power ON/OFF	Logic 2
	Counter	Logic 4 ～ 7
	TAPE speed (PLAY)	Logic 1
	▭ display	Logic 1
	REC INHIBIT	Logic 1

IC601 (TMP4746N5760) Output Logic Levels

Pin No.	MODE	ACTIVE	SLOT IN		SLOT OUT		LOADING		UNLOAD ING		STOP		FF	
			SP	EP	SP	EP	SP	EP	SP	EP	SP	EP	SP	EP
1	REEL PB	H	L		L		L		H		L		L	
2	REEL REV	H	L		L		L		L		L		L	
4	SPEED HOLD	H	H	H	H	H	H/L	H/L	H/L	H/L	H	H	H	H
5	SPEED A	–	H	L	H	L	H	L	H	L	H	L	H	L
6	SPEED B	–	L	L	L	L	L	L	L	L	L	L	L	L
7	BRAKE BIAS	H	L		L		L		L		L		L	
8	STEP SLOW	H	L		L		L		L		L		L	
11	CAP ON	L	H		H		H		H		H		H	
12	CAP F/R	L	H		H		H		H		H		H	
13	REEL. CL	H	L		L		L		H		L		L	
19	REEL (+)	L	H		H		L		H		H		L	
20	REEL (–)	L	H		H		H		L		H		H	
21	REEL A	H	L		L		L		⊓⊓⊓		L		Lor ⊓⊓⊓	
22	REEL B	H	L		L		H		L		L		L	
26	TRICK	H	L		L		L		L		L		L	
27	PLAY +B	L	H		H		H		H		H		H	
28	REC +B	L	H		H		H		H		H		H	
29	PAUSE LED	L	H		H		H		H		H		H	
30	Pre PLAY +B	L	H		H		H		H		H		H	
33	DRUM ON	L	H		H		L		L		H		H	
34	PLAY LED	L	H		H		H		H		H		H	
35	STILL SLOW	L	L		L		L		L		L		L	
36	TV/VTR	L												
37	HEAD B	–	H	L	H	L	H	L	H	L	H	L	H	L
38	HEAD A	–	H	L	H	L	H	L	H	L	H	L	H	L
39	GAIN 1	H	H	H	H	H	H	H/L	H	H/L	H	H	H	H
40	GAIN 2	H	L	L	L	L	L	L	L	L	L	L	L	L
41	REC MUTE	H	H		H		H		H		H		H	
42	AUDIO MUTE	H	L		L		L		L		L		L	
43	NOISELESS TRICK	H	L		L		L		L		L		L	
44		H	L		L		L		L		L		L	
60	FLM. A	–	L		L		H		H		H		H	
61	FLM. B	–	H		H		L		L		H		H	
62	FLM. C	–	L		H		L		H		H		H	
63	LOADING	H	L		L		H		H		L		L	
	Servo IC		Inspection x1		Inspection x1		–		–		Inspection x1		Inspection x1	
	Mecha position		II		II		–		–		II		I	



)NSTANT CURRENT CONTROL
LAY,REC,STILL,CUE UNLOADING)
ONSTANT CURRENT CONTROL
EVIEW, REVERSE)

TRANSMISSION

SPEED
ITROL

Mode \ Control Mode		Hold	Speed A	Speed B
PLAY CUE/REVIEW	SP	L	H	L
	LP	L	L	H
	EP	L	L	L
Other than above	SP	H	H	L
	EP	H	L	L

LOW CAPSTAN REVERSE BRAKE CONTROL
'SE BRAKE at"H")
LOW CONTROL
TEP MODE)

TAN MOTOR CONTROL

Capstan Motor	CAP ON	CAP F/R
Stop	H	H
Normal direction	L	H
Reverse direction	L	L

IRRENT LIMITER CONTROL
NT LIMITER MODE at "H")

CAM SW A INPUT
7

CAM SW B INPUT
7

ART SENSOR INPUT
TART at"L")

ID SENSOR INPUT
ND at"L")

)TOR DIRECTION SWITCHING
RD ROTATION at"L")

)TOR DIRECTION SWITCHING
SE ROTATION at"L")

. MOTOR VOLTAGE CONTROL

'O IC CONTROL

. PLAYBACK SIGNAL
T SPECIAL PLAYBACK at PLAYBACK MODE :"H")

B CONTROL
-B OUTPUT at"L")

, REC LED CONTROL
) OUTPUT at"L", REC LED LIGHTS UP)

.ED CONTROL
ISE LED LIGHTS UP)

AY +B CONTROL
'LAY +B OUTPUT at"L")

---- PULL UP RESISTANCE INSTALLED

Period: 30ms

Direction	Data	
Timer → Logic	Power ON/OFF Key & remote control input Timer recording Auto PLAY mode Counter memory mode Counter reset TAPE speed TV/VCR Counter (back-up)	Timer 2 Timer 2·3 Timer 2·3 Timer 1 Timer 1 Timer 2·3 Timer 1 Timer 1 Timer 4 ~ 7
Logic → Timer	Mode data Power ON/OFF Counter TAPE speed (PLAY) ▭ display REC INHIBIT	Logic 2·3 Logic 2 Logic 4 ~ 7 Logic 1 Logic 1 Logic 1

IC601 (TMP4746N5760) Output Logic Levels

Pin No.	MODE	ACTIVE	SLOT IN SP	SLOT IN EP	SLOT OUT SP	SLOT OUT EP	LOADING SP	LOADING EP	UNLOADING SP	UNLOADING EP	STOP SP	STOP EP	FF SP	FF EP	REW SP	REW EP
1	REEL PB	H	L		L		L		H		L		L		L	
2	REEL REV	H	L		L		L		L		L		L		L	
4	SPEED HOLD	H	H	H	H	H	H/L	H/L	H/L	H/L	H	H	H	H	H	H
5	SPEED A	–	H	L	H	L	H	L	H	L	H	L	H	L	H	L
6	SPEED B	–	L	L	L	L	L	L	L	L	L	L	L	L	L	L
7	BRAKE BIAS	H	L		L		L		L		L		L		L	
8	STEP SLOW	H	L		L		L		L		L		L		L	
11	CAP ON	L	H		H		H		H		H		H		H	
12	CAP F/R	L	H		H		H		H		H		H		H	
13	REEL. CL	H	L		L		L		H		L		L		L	
19	REEL (+)	L	H		H		L		H		H		L		H	
20	REEL (–)	L	H		H		H		L		H		H		L	
21	REEL A	H	L		L		L		⎍⎍⎍		L		Lor ⎍⎍⎍		Lor ⎍⎍⎍	
22	REEL B	H	L		L		H		L		L		L		L	
26	TRICK	H	L		L		L		L		L		L		L	
27	PLAY +B	L	H		H		H		H		H		H		H	
28	REC +B	L	H		H		H		H		H		H		H	
29	PAUSE LED	L	H		H		H		H		H		H		H	
30	Pre PLAY +B	L	H		H		H		H		H		H		H	
33	DRUM ON	L	H		H		L		L		H		H		H	
34	PLAY LED	L	H		H		H		H		H		H		H	
35	STILL SLOW	L	L		L		L		L		L		L		L	
36	TV/VTR	L														
37	HEAD B	–	H	L	H	L	H	L	H	L	H	L	H	L	H	L
38	HEAD A	–	H	L	H	L	H	L	H	L	H	L	H	L	H	L
39	GAIN 1	H	H	H	H	H	H	H/L	H	H/L	H	H	H	H	H	H
40	GAIN 2	H	L	L	L	L	L	L	L	L	L	L	L	L	L	L
41	REC MUTE	H	H		H		H		H		H		H		H	
42	AUDIO MUTE	H	L		L		L		L		L		L		L	
43	NOISELESS TRICK	H	L		L		L		L		L		L		L	
44		H	L		L		L		L		L		L		L	
60	FLM. A	–	L		L		H		H		H		H		H	
61	FLM. B	–	H		H		L		L		H		H		H	
62	FLM. C	–	L		H		L		H		H		H		H	
63	LOADING	H	L		L		H		H		L		L		L	
	Servo IC		Inspection x1		Inspection x1		–		–		Inspection x1		Inspection x1		Inspection x1	
	Mecha position		II		II		–		–		II		I		I	

Pin No.	MODE	CUE SPx5	CUE LPx5	CUE EPx5	CUE EPx15	REVIEW SPx5	REVIEW LPx5	REVIEW EPx5	REVIEW EPx15	PLAY SP	PLAY LP	PLAY EP
1	REEL PB	H				L				H		
2	REEL REV	L				H				L		
4	SPEED HOLD	L	L	L	L	L	L	L	L	L	L	L
5	SPEED A	H	L	L	L	H	L	L	L	H	L	L
6	SPEED B	L	H	L	L	L	H	L	L	L	H	L
7	BRAKE BIAS	L				L				L		
8	STEP SLOW	L				L				L		
11	CAP ON	L				L				L		
12	CAP F/R	H				L				H		
13	REEL. CL	H				H				H		
19	REEL (+)	L				H				L		
20	REEL (–)	H				L				H		
21	REEL A	⎍⎍⎍				⎍⎍⎍				⎍⎍⎍		
22	REEL B	L				L				L		
26	TRICK	H				H				L		
27	PLAY +B	L				L				L		
28	REC +B	H				H				H		
29	PAUSE LED	H				H				H		
30	Pre PLAY +B	L				L				L		
33	DRUM ON	L				L				L		
34	PLAY LED	L				L				L		
35	STILL SLOW	H				H				H		
36	TV/VTR	‾↓_				‾↓_				‾↓_		
37	HEAD B	H	L	L	L	H	L	L	L	H	L	L
38	HEAD A	H	L	L	L	H	L	L	L	H	L	L
39	GAIN 1	L	L	L	H	L	H	L	L	H	H	L
40	GAIN 2	H	H	H	H	H	H	H	H	L	L	L
41	REC MUTE	H				H				H		
42	AUDIO MUTE	H				H				L		
43	NOISELESS TRICK	H	L			H	L			L		
44		L				L				L		
60	FLM. A	H				H				H		
61	FLM. B	H				H				H		
62	FLM. C	H				H				H		
63	LOADING	L				L				L		
	Servo IC	CUEx5			CUE x15	REVIEWx5			REV x15	PLAYx1		
	Mecha position	V				VIII				V		

Pin No.	MODE	STILL SP	STILL LP	STILL EP	STEP SLOW SP	STEP SLOW LP	STEP SLOW EP	REC SP	REC EP	REC PAUSE SP	REC PAUSE EP	EDITING REWIND SP	EDITING REWIND EP
1	REEL PB	H			H			H		L		__⎍	
2	REEL REV	L			L			L		L		_⎍__	
4	SPEED HOLD	H	H	H	H	H	H	H	H	H	H	H	H
5	SPEED A	H	L	L	H	L	L	H	L	H	L	H	L
6	SPEED B	L	H	L	L	H	L	L	L	L	L	L	L
7	BRAKE BIAS	L			___⎍_			L		L		L	
8	STEP SLOW	L			_⎍‾‾_			L		L		L	
11	CAP ON	H			‾⊔‾			L		H		⎍_⎍⊔	
12	CAP F/R	H			‾‾⊔‾			H		H		‾⊔⎍⊔	
13	REEL. CL	L			L			H		L		H	
19	REEL (+)	L			L			L		H		_⎍‾⊔	
20	REEL (–)	H			H			H		H		‾⊔‾	
21	REEL A	H			‾⊔‾			⎍⎍⎍		L		⎍⎍⎍	
22	REEL B	H			H			L		L		L	
26	TRICK	H			H			L		L			
27	PLAY +B	L			L			H		H		H	
28	REC +B	H			H			L		L		L/H	
29	PAUSE LED	L			L			H		L		L/H	
30	Pre PLAY +B	L			L			H		H		H	
33	DRUM ON	L			L			L		L		L	
34	PLAY LED	L			L			H		H		H	
35	STILL SLOW	L			_⎍_			H		L		⎍_⎍⊔	
36	TV/VTR	‾↓_											
37	HEAD B	L	H	H	L	H	H	H	L	H	L	H	L
38	HEAD A	H	L	L	H	L	L	H	L	H	L	H	L
39	GAIN 1	H	H	H	‾⊔‾			H	L	H	L	H	L
40	GAIN 2	L	L	L	L	L	L	L	L	L	L	L	L
41	REC MUTE	H			H			‾↓_		H		H	
42	AUDIO MUTE	H			H			L		L		L	
43	NOISELESS TRICK	L			L			_⎍_		L		L	
44		L			L			L		L		L	
60	FLM. A	H			H			H		H		H	
61	FLM. B	H			H			H		H		H	
62	FLM. C	H			H			H		H		H	
63	LOADING	L			L			L		L		L	
	Servo IC	REVIEWx0			REVIEWx1			RECx1		Inspection x1		Inspection x1	
	Mecha position	V			V			V		V		V	

Logic Mode Shift Table

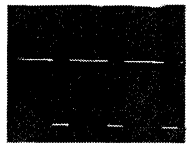
△ . . . Same as normal mode shift
○ . . . Directly shifted to the specified mode
X . . . Not shifted

Current Mode \ Input	⏏ EJECT	□ STOP	◁◁ REW/ REVIEW	▷▷ FF/ CUE	▷ PLAY	▯▯ PAUSE/ STILL	▯▷ STEP/ SLOW	○ REC	☝ OTR (Timer REC)
SLOT IN	○	△	△	△	△	△	X	X	EJECT
SLOT OUT	–	X	X	X	X	X	X	X	X
STOP	○	–	○	○	○	X	X	○	○
FF	○	○	○	–	○	X	X	X	○
REW	○	○	–	○	○	X	X	X	○
CUE	○	○	REVIEW	*CUE	○	X	X	X	○
REVIEW	○	○	*REVIEW	CUE	○	X	X	X	○
PLAY	○	○	REVIEW	CUE	○	STILL	X	X	○
STILL	○	○	REVIEW	CUE	X	PLAY	STEP	REC PAUSE	○
REC	X	○	X	X	X	REC PAUSE	X	–	○
REC PAUSE	X	○	X	X	X	REC	X	X	○
Timer REC	X	X	X	X	X	X	X	X	–

Note: Operations by remote controller are available except EJECT, OTR.
* When being pushed during EP mode, 15 times normal speed is available (in normal mode, 5 times speed).
When being pushed, speed becomes approx. 1/10.

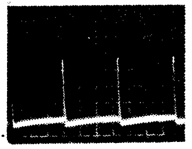
12-1. Servo Block Diagram

❶ **Rec**



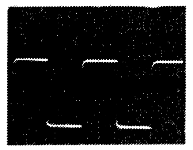
V: 1V/div.
H: 10ms/div.

❷ **Rec**



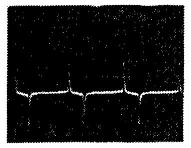
V: 0.2V/div
H: 5ms/div

❸ **Play (EP)**



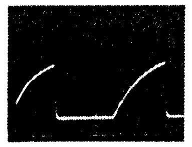
V: 1V/div.
H: 1ms/div.

❹ **Play**



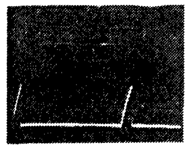
V: 1V/div.
H: 10ms/div.

❺ **Play**



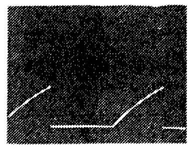
V: 1V/div.
H: 5ms/div.

❻ **Rec, Play (SP)**



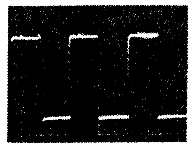
V: 1V/div.
H: 5ms/div.

❼ **Rec, Play (EP)**



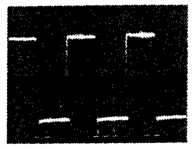
V: 1V/div.
H: 5ms/div.

❽ **Rec, Play, Cue/Review**



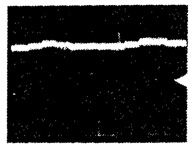
V: 1V/div.
H: 5μs/div.

❾ **Rec, Play, Cue/Review**



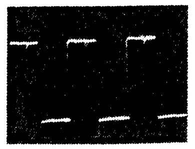
V: 1V/div.
H: 5μs/div.

❿ **Rec, Play, Cue/Review**



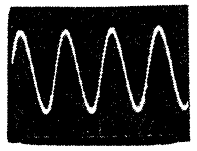
V: 1V/div.
H: 0.5ms/div.

⓫ **Rec, Play, Cue/Review**



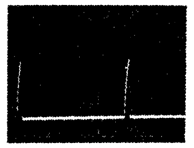
V: 1V/div.
H: 5μs/div.

⓬ **Rec, Play, Cue/Review, Slow**



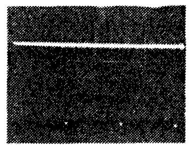
V: 2V/div.
H: 0.5ms/div.

⓭ **Rec, Play, Cue/Review, Slow**



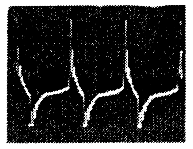
V: 1V/div.
H: 5ms/div.

⓮ **Still/Slow, Cue/Review**



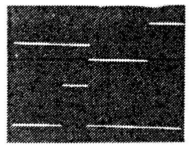
V: 1V/div.
H: 5ms/div.

⓯ **Cue/Review**



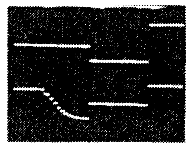
V: 1V/div.
H: 2ms/div.

⓰ **Slow**



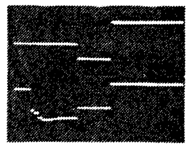
V: 5V/div.
H: 10ms/div.

⓱ **Slow (SP)**

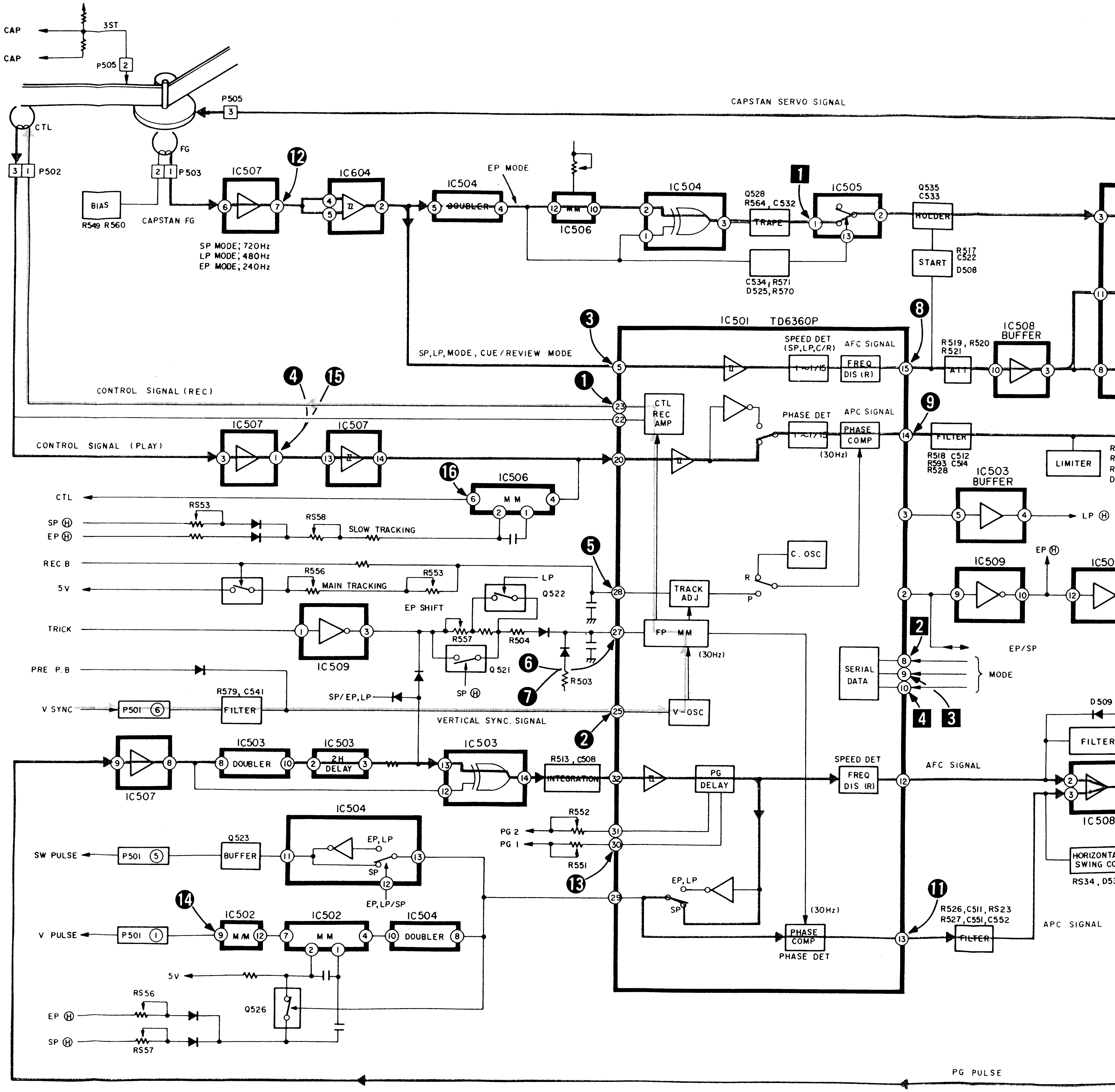


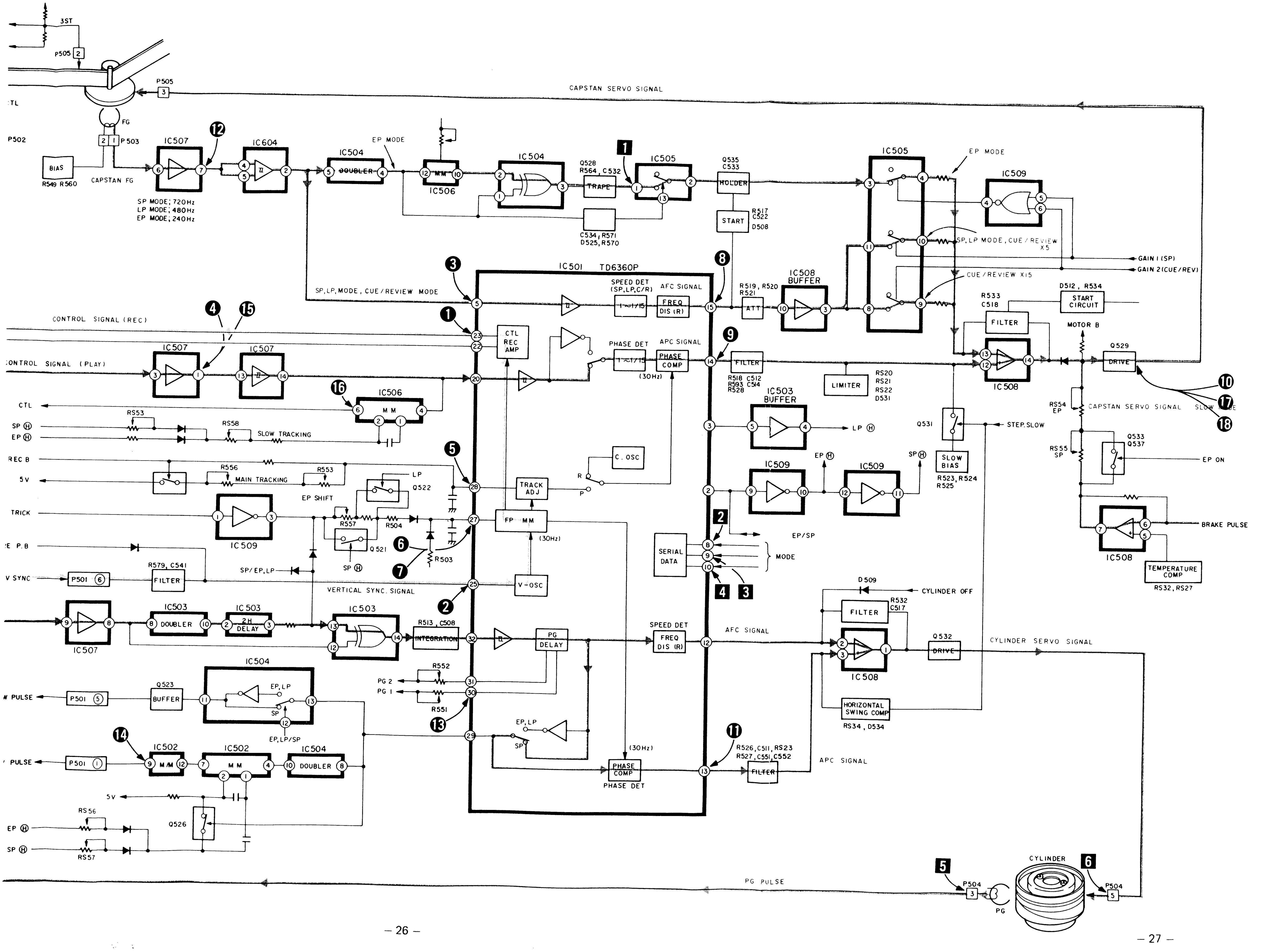
V: 5V/div.
H: 10ms/div.

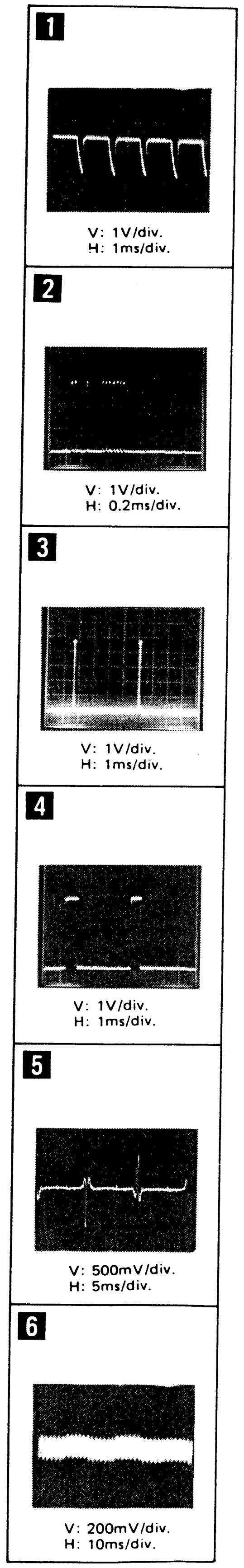
⓲ **Slow (EP)**



V: 5V/div.
H: 10ms/div.

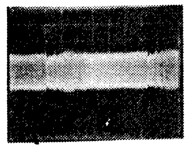

CAP
CAP
3ST
P505
P505
CTL
FG
P502
P503
BIAS
R549 R560
CAPSTAN FG
IC507
IC604
SP MODE; 720Hz
LP MODE; 480Hz
EP MODE; 240Hz
IC504
DOUBLER
EP MODE
MM
IC506
IC504
Q528
R564, C532
TRAPE
IC505
C534, R571
D525, R570
Q535
C533
HOLDER
START
R517
C522
D508
CAPSTAN SERVO SIGNAL
IC501 TD6360P
SPEED DET (SP,LP,C/R)
AFC SIGNAL
1~1/15
FREQ DIS (R)
SP, LP, MODE, CUE/REVIEW MODE
R519, R520
R521
ATT
IC508 BUFFER
CONTROL SIGNAL (REC)
CTL REC AMP
PHASE DET
APC SIGNAL
1~1/15
PHASE COMP
(30Hz)
FILTER
R518 C512
R593 C514
R528
LIMITER
CONTROL SIGNAL (PLAY)
IC507
IC507
IC506
M M
IC503 BUFFER
LP Ⓗ
CTL
SP Ⓗ
EP Ⓗ
RS53
RS58
SLOW TRACKING
REC B
5V
R556
MAIN TRACKING
R553
LP
Q522
EP SHIFT
C. OSC
R
P
TRACK ADJ
IC509
EP Ⓗ
TRICK
IC509
R557
R504
Q521
FP MM
(30Hz)
R503
SP Ⓗ
SERIAL DATA
EP/SP
MODE
PRE P.B
SP/EP, LP
V SYNC
P501 ⑥
R579, C541
FILTER
VERTICAL SYNC. SIGNAL
V-OSC
D509
FILTER
IC507
IC503
DOUBLER
IC503
2H DELAY
IC503
R513, C508
INTEGRATION
PG DELAY
SPEED DET
FREQ DIS (R)
AFC SIGNAL
IC508
PG 2
PG 1
R552
R551
SW PULSE
P501 ⑤
Q523
BUFFER
IC504
EP, LP
SP
EP, LP/SP
EP, LP
SP
(30Hz)
PHASE COMP
PHASE DET
R526, C511, RS23
R527, C551, C552
FILTER
APC SIGNAL
RS34
V PULSE
P501 ①
IC502
M/M
IC502
M M
IC504
DOUBLER
5V
RS56
Q526
EP Ⓗ
SP Ⓗ
RS57
PG PULSE

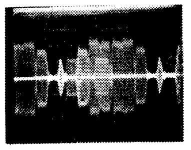

3ST
P505 2
P505 3
CAPSTAN SERVO SIGNAL
TL
FG
P502
2 1 P503
BIAS
R549 R560
CAPSTAN FG
IC507
⓬
IC604
EP MODE
IC504
DOUBLER
MM
IC506
IC504
Q528
R564, C532
TRAPE
C534, R571
D525, R570
❶
IC505
Q535
C533
HOLDER
START
R517
C522
D508
IC505
EP MODE
IC509
SP, LP MODE, CUE/REVIEW X5
CUE/REVIEW X15
GAIN 1 (SP)
GAIN 2 (CUE/REV)
SP MODE; 720Hz
LP MODE; 480Hz
EP MODE; 240Hz
❸
IC501 TD6360P
❽
SP, LP, MODE, CUE/REVIEW MODE
SPEED DET (SP,LP,C/R)
AFC SIGNAL
1~1/15
FREQ DIS (R)
R519, R520
R521
ATT
IC508 BUFFER
R533
C518
D512, R534
START CIRCUIT
FILTER
MOTOR B
CONTROL SIGNAL (REC)
❹ ⓯
❶
CTL REC AMP
PHASE DET
APC SIGNAL
PHASE COMP
(30Hz)
❾
FILTER
R518 C512
R593 C514
R528
LIMITER
RS20
RS21
RS22
D531
IC508
Q529
DRIVE
❿
⓱
⓲
CONTROL SIGNAL (PLAY)
IC507
IC507
⓰
IC506
MM
CTL
SP Ⓗ
EP Ⓗ
RS53
RS58
SLOW TRACKING
IC503 BUFFER
LP Ⓗ
Q531
STEP. SLOW
RS54 EP
CAPSTAN SERVO SIGNAL
SLOW MODE
REC B
5V
RS56
MAIN TRACKING
R553
❺
LP
Q522
EP SHIFT
C. OSC
R
P
TRACK ADJ
EP Ⓗ
IC509
IC509
SP Ⓗ
SLOW BIAS
R523, R524
R525
RS55 SP
Q533
Q537
EP ON
TRICK
IC509
R557
R504
FP MM
(30Hz)
❻
❼
R503
Q521
SP Ⓗ
SERIAL DATA
❷
EP/SP
MODE
❹ ❸
IC508
BRAKE PULSE
TEMPERATURE COMP
RS32, RS27
E P.B
V SYNC
P501 ⑥
R579, C541
FILTER
SP/EP, LP
VERTICAL SYNC. SIGNAL
❷
V-OSC
D509
CYLINDER OFF
R532
C517
FILTER
IC507
IC503
DOUBLER
IC503
2H DELAY
IC503
R513, C508
INTEGRATION
PG DELAY
SPEED DET
FREQ DIS (R)
AFC SIGNAL
Q532
DRIVE
CYLINDER SERVO SIGNAL
IC508
IC504
W PULSE
P501 ⑤
Q523
BUFFER
EP, LP
SP
EP, LP/SP
R552
PG 2
PG 1
R551
⓭
HORIZONTAL SWING COMP
RS34, D534
⓮
IC502
IC502
IC504
PULSE
P501 ①
M/M
MM
DOUBLER
EP, LP
SP
(30Hz)
PHASE COMP
PHASE DET
⓫
R526, C511, RS23
R527, C551, C552
FILTER
APC SIGNAL
5V
Q526
EP Ⓗ
SP Ⓗ
RS56
RS57
CYLINDER
❺
❻
P504 3
PG
P504 5
PG PULSE

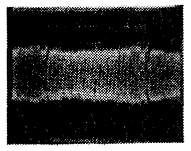

❶
V: 1V/div.
H: 1ms/div.
❷
V: 1V/div.
H: 0.2ms/div.
❸
V: 1V/div.
H: 1ms/div.
❹
V: 1V/div.
H: 1ms/div.
❺
V: 500mV/div.
H: 5ms/div.
❻
V: 200mV/div.
H: 10ms/div.

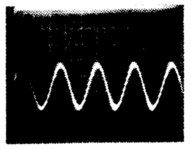
13-1. Video Block Diagram

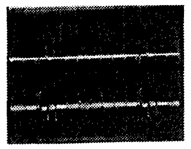
PLAY

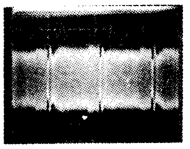

①
V: 50mV/div.
H: 10μs/div.

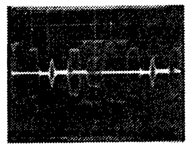

⑪
V: 0.2V/div.
H: 10μs/div.

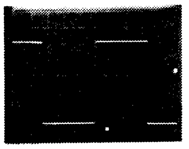

②
V: 50mV/div.
H: 10μs/div.

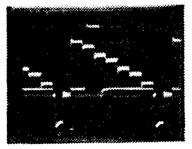

⑫
V: 50mV/div.
H: 10μs/div.

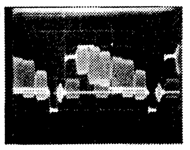

③
V: 0.2V/div.
H: 10μs/div.

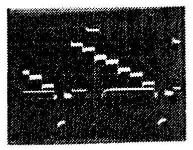

⑬
V: 0.1V/div.
H: 5ms/div.

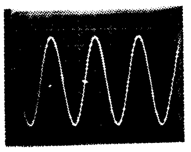

④
V: 0.1V/div.
H: 10μs/div.

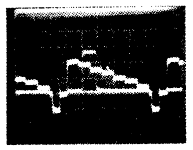

⑭
V: 1V/div.
H: 5ms/div.

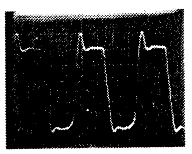

⑤
V: 0.2V/div.
H: 10μs/div.

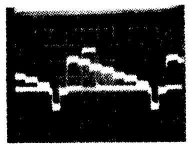

⑮
V: 0.5V/div.
H: 10μs/div.

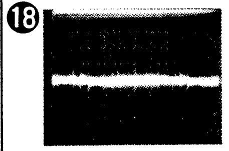

⑥
V: 0.2V/div.
H: 10μs/div.

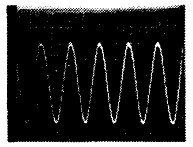

⑯
V: 0.1V/div.
H: 0.1μs/div.

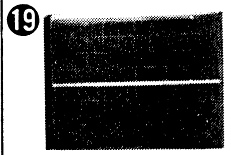

⑦
V: 0.2V/div.
H: 10μs/div.

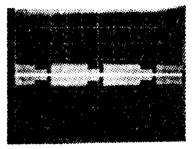

⑰
V: 0.1V/div.
H: 0.05μs/div.

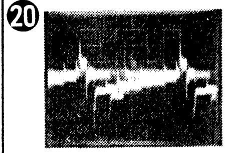

⑧
V: 0.2V/div.
H: 10μs/div.

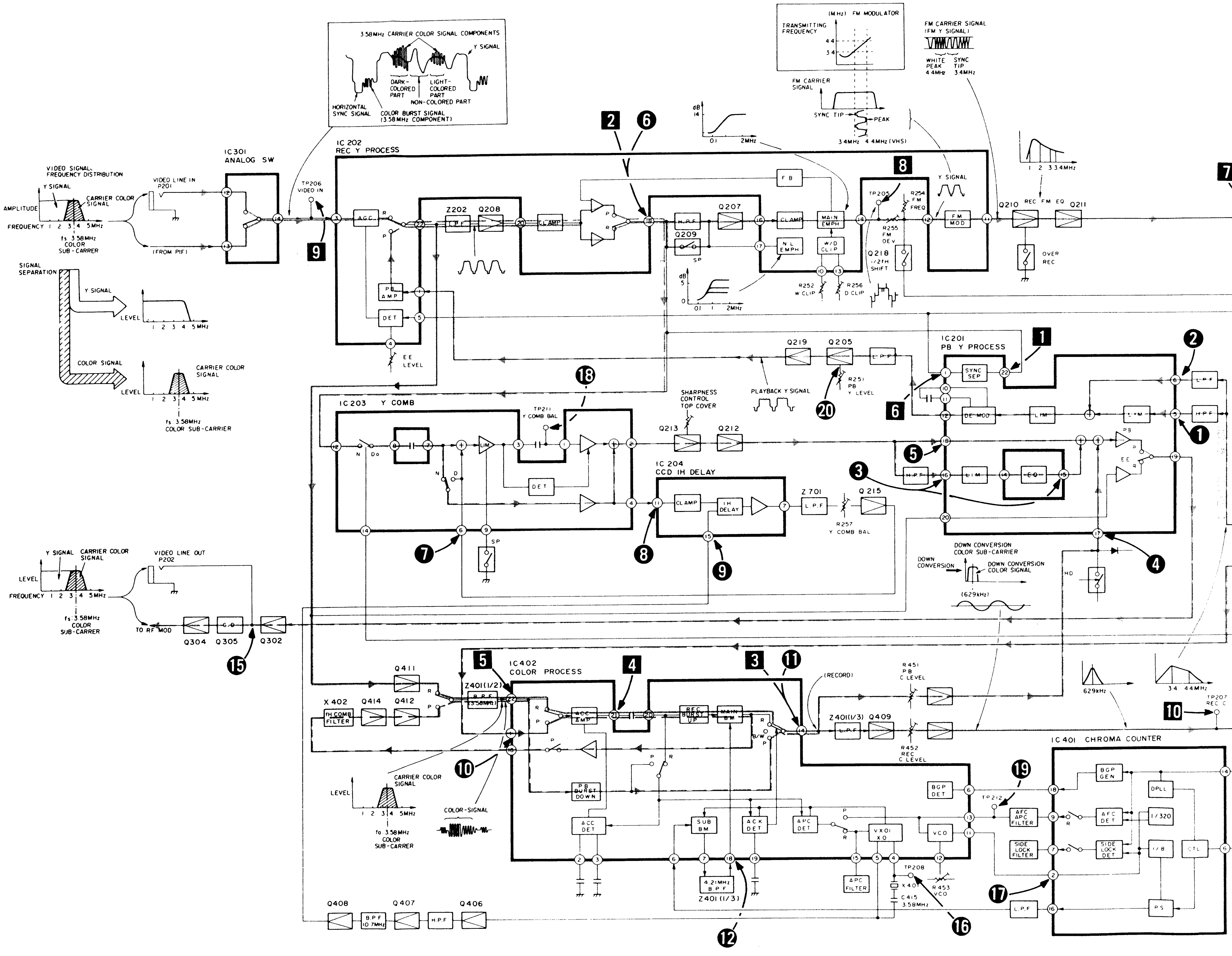

⑱
V: 0.5V/div.
H: 10μs/div.

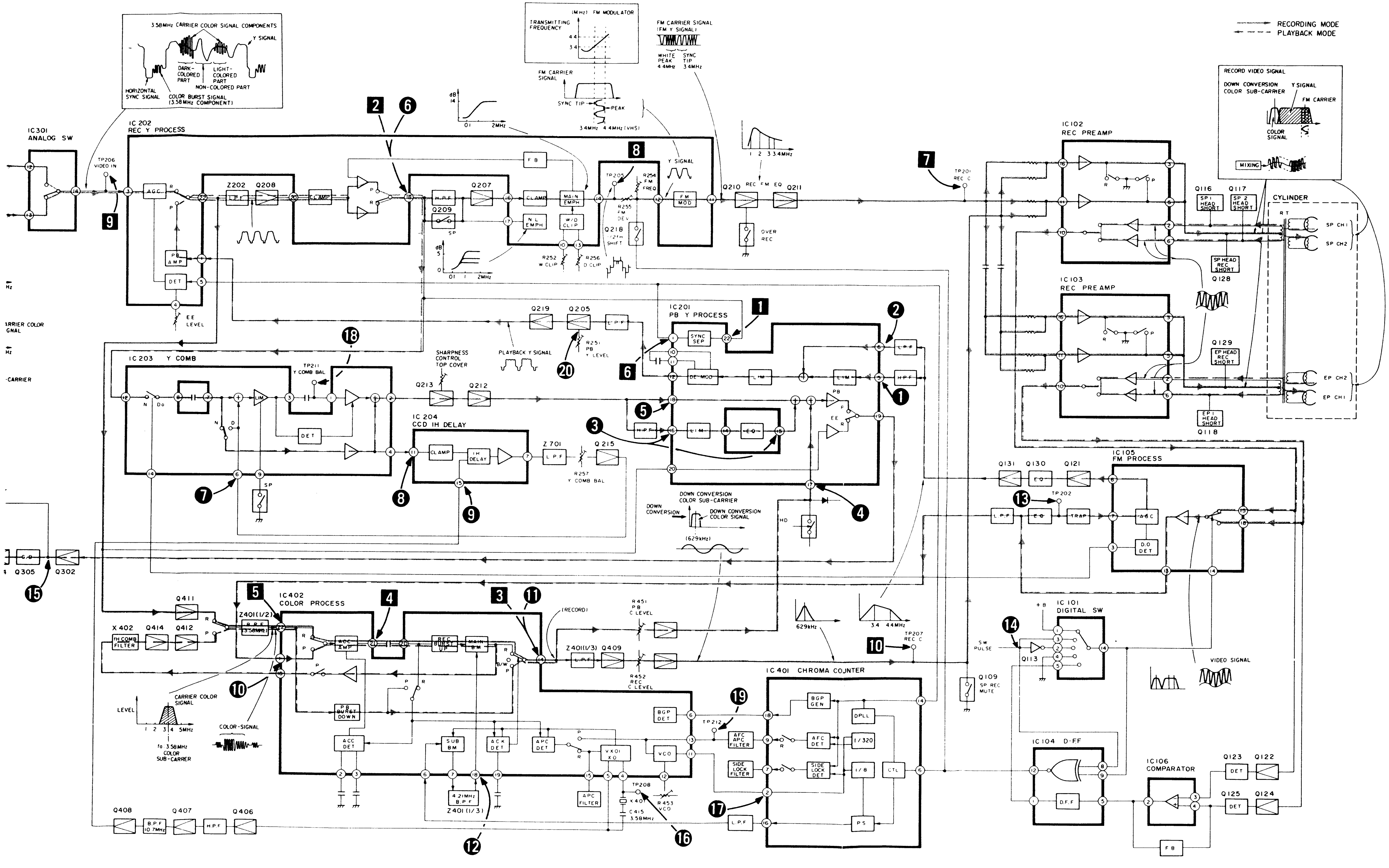

⑨
V: 0.1V/div.
H: 0.05μs/div.


⑲
V: 20mV/div.
H: 5ms/div.


⑩
V: 0.2V/div.
H: 5ms/div.

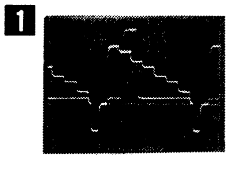

⑳
V: 50mV/div.
H: 10μs/div.

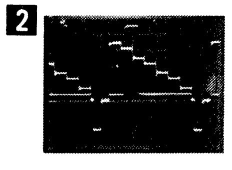

VIDEO SIGNAL FREQUENCY DISTRIBUTION
Y SIGNAL
CARRIER COLOR SIGNAL
AMPLITUDE
FREQUENCY 1 2 3 4 5MHz
fs 3.58MHz COLOR SUB-CARRER
SIGNAL SEPARATION
Y SIGNAL
LEVEL
1 2 3 4 5MHz
COLOR SIGNAL
CARRIER COLOR SIGNAL
LEVEL
1 2 3 4 5MHz
fs 3.58MHz COLOR SUB-CARRIER
VIDEO LINE IN P201
(FROM PIF)
IC301 ANALOG SW
3.58MHz CARRIER COLOR SIGNAL COMPONENTS
Y SIGNAL
DARK-COLORED PART
LIGHT-COLORED PART
NON-COLORED PART
HORIZONTAL SYNC SIGNAL
COLOR BURST SIGNAL (3.58MHz COMPONENT)
TP206 VIDEO IN
9
IC 202 REC Y PROCESS
AGC
R
P
PB AMP
DET
EE LEVEL
Z202
Q208
LPF
CLAMP
2
6
HPF
Q207
Q209
SP
CLAMP
MAIN EMPH
N.L EMPH
W/D CLIP
FB
dB 14
0.1 2MHz
dB 5 0
0.1 1 2MHz
R252 W CLIP
R256 D CLIP
(MHz) FM MODULATOR
TRANSMITTING FREQUENCY
4.4
3.4
FM CARRIER SIGNAL
SYNC TIP
PEAK
3.4MHz 4.4MHz (VHS)
8
TP205
R254 FM FREQ
R255 FM DEV
Q218 1/2fH SHIFT
Y SIGNAL
FM MOD
FM CARRIER SIGNAL (FM Y SIGNAL)
WHITE PEAK 4.4MHz
SYNC TIP 3.4MHz
Q210
REC FM EQ
Q211
1 2 3 3.4MHz
OVER REC
7
Q219
Q205
L.P.F
R251 PB Y LEVEL
PLAYBACK Y SIGNAL
20
SHARPNESS CONTROL TOP COVER
Q213
Q212
IC201 PB Y PROCESS
1
SYNC SEP
6
DE MOD
LIM
L.P.F
H.P.F
2
1
5
3
H.P.F
LIM
EQ
PB
EE
P
R
4
DOWN CONVERSION COLOR SUB-CARRIER
DOWN CONVERSION
DOWN CONVERSION COLOR SIGNAL
(629kHz)
HD
IC203 Y COMB
N Do
LIM
N D
DET
TP211 Y COMB BAL
18
SP
7
8
IC 204 CCD IH DELAY
CLAMP
IH DELAY
Z 701
L.P.F
R257 Y COMB BAL
Q 215
9
Y SIGNAL
CARRIER COLOR SIGNAL
LEVEL
FREQUENCY 1 2 3 4 5MHz
fs 3.58MHz COLOR SUB-CARRER
VIDEO LINE OUT P202
TO RF MOD
Q304
Q305
G.D
Q302
15
Q411
X 402
fH COMB FILTER
Q414
Q412
R
P
5
Z401(1/2)
B.P.F (3.58MHz)
IC402 COLOR PROCESS
ACC AMP
4
REC BURST UP
MAIN BM
3
11
R
B/W
P
PB BURST DOWN
ACC DET
SUB BM
ACK DET
APC DET
4.21MHz B.P.F
Z401 (1/3)
12
10
CARRIER COLOR SIGNAL
LEVEL
1 2 3 4 5MHz
fo 3.58MHz COLOR SUB-CARRER
COLOR-SIGNAL
Q408
B.P.F 10.7MHz
Q407
H.P.F
Q406
(RECORD)
R451 PB C LEVEL
Z401(1/3)
Q409
L.P.F
R452 REC C LEVEL
629kHz
3.4 4.4MHz
TP207 REC C
10
BGP DET
VXO1 XO
VCO
APC FILTER
TP208
X401
C415 3.58MHz
R453 VCO
16
19
TP212
AFC APC FILTER
SIDE LOCK FILTER
L.P.F
17
IC401 CHROMA COUNTER
BGP GEN
DPLL
AFC DET
1/320
SIDE LOCK DET
1/8
CTL
PS

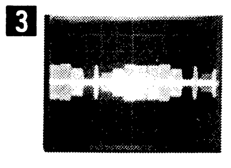


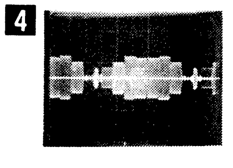
3.58MHz CARRIER COLOR SIGNAL COMPONENTS
Y SIGNAL
DARK-COLORED PART
LIGHT-COLORED PART
NON-COLORED PART
HORIZONTAL SYNC SIGNAL
COLOR BURST SIGNAL (3.58MHz COMPONENT)
(MHz) FM MODULATOR
TRANSMITTING FREQUENCY
4.4
3.4
FM CARRIER SIGNAL
SYNC TIP
PEAK
3.4MHz 4.4MHz (VHS)
FM CARRIER SIGNAL (FM Y SIGNAL)
WHITE PEAK 4.4MHz
SYNC TIP 3.4MHz
RECORDING MODE
PLAYBACK MODE
RECORD VIDEO SIGNAL
DOWN CONVERSION COLOR SUB-CARRIER
Y SIGNAL
FM CARRIER
COLOR SIGNAL
MIXING
IC301 ANALOG SW
TP206 VIDEO IN
IC202 REC Y PROCESS
A.G.C.
Z202
Q208
L.P.F
CLAMP
H.P.F
Q207
Q209
CLAMP
MAIN EMPH
N.L EMPH
W/D CLIP
F.B
TP205
R254 FM FREQ
R255 FM DEV
Q218 1/2fH SHIFT
FM MOD
R252 W CLIP
R256 D CLIP
PB AMP
DET
EE LEVEL
Y SIGNAL
Q210 REC FM EQ Q211
OVER REC
1 2 3 3.4MHz
TP201 REC C
IC102 REC PREAMP
IC103 REC PREAMP
Q116 SP1 HEAD SHORT
Q117 SP2 HEAD SHORT
SP HEAD REC SHORT
Q128
Q129 EP HEAD REC SHORT
EP1 HEAD SHORT
Q118
CYLINDER
R.T
SP CH1
SP CH2
EP CH2
EP CH1
Q219
Q205
L.P.F
R251 PB Y LEVEL
IC201 PB Y PROCESS
SYNC SEP
DE MOD
LIM
L.P.F
H.P.F
PB
EE
R
EQ
PLAYBACK Y SIGNAL
SHARPNESS CONTROL TOP COVER
IC203 Y COMB
TP211 Y COMB BAL
LIM
DET
Q213
Q212
IC204 CCD 1H DELAY
CLAMP
1H DELAY
Z701
L.P.F
Q215
R257 Y COMB BAL
DOWN CONVERSION
DOWN CONVERSION COLOR SUB-CARRIER
DOWN CONVERSION COLOR SIGNAL
(629kHz)
HD
Q131 Q130 Q121
IC105 FM PROCESS
TP202
EQ
TRAP
AGC
D.O DET
Q305
Q302
Q411
IC402 COLOR PROCESS
Z401(1/2)
B.P.F 3.58MHz
ACC AMP
REC BURST UP
MAIN BM
B/W
(RECORD)
R451 PB C LEVEL
R452 REC C LEVEL
Z401(1/3) Q409
629kHz
3.4 4.4MHz
TP207 REC C
X402 1H COMB FILTER
Q414 Q412
PB BURST DOWN
ACC DET
SUB BM
ACK DET
APC DET
VXO1 XO
VCO
APC FILTER
4.21MHz B.P.F
Z401(1/3)
TP208
X401
C415 3.58MHz
R453 VCO
BGP DET
TP212
AFC APC FILTER
SIDE LOCK FILTER
L.P.F
IC401 CHROMA COUNTER
BGP GEN
AFC DET
SIDE LOCK DET
DPLL
1/320
1/8
CTL
PS
CARRIER COLOR SIGNAL
LEVEL
1 2 3 4 5MHz
f0 3.58MHz COLOR SUB-CARRIER
COLOR-SIGNAL
Q408
B.P.F 10.7MHz
Q407
H.P.F
Q406
Q109 SP REC MUTE
SW PULSE
+B
IC101 DIGITAL SW
Q113
VIDEO SIGNAL
IC104 D-FF
D.F.F
IC106 COMPARATOR
Q123 Q122
DET
Q125 Q124
DET
F.B
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20

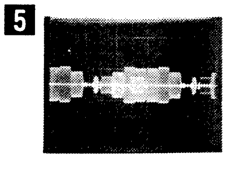
REC

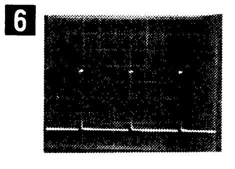

V: 0.2V/div.
H: 10μs/div.

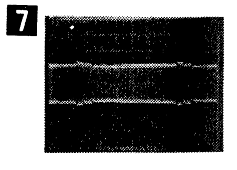

V: 0.2V/div.
H: 10μs/div.

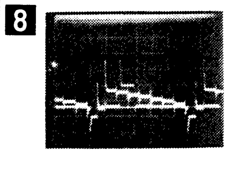

V: 0.5V/div.
H: 10μs/div.

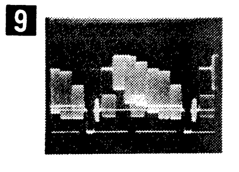

V: 0.2V/div.
H: 10μs/div.

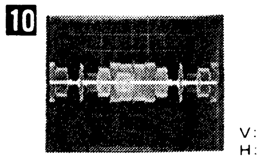

V: 0.1V/div.
H: 10μs/div.


V: 1V/div.
H: 20μs/div.

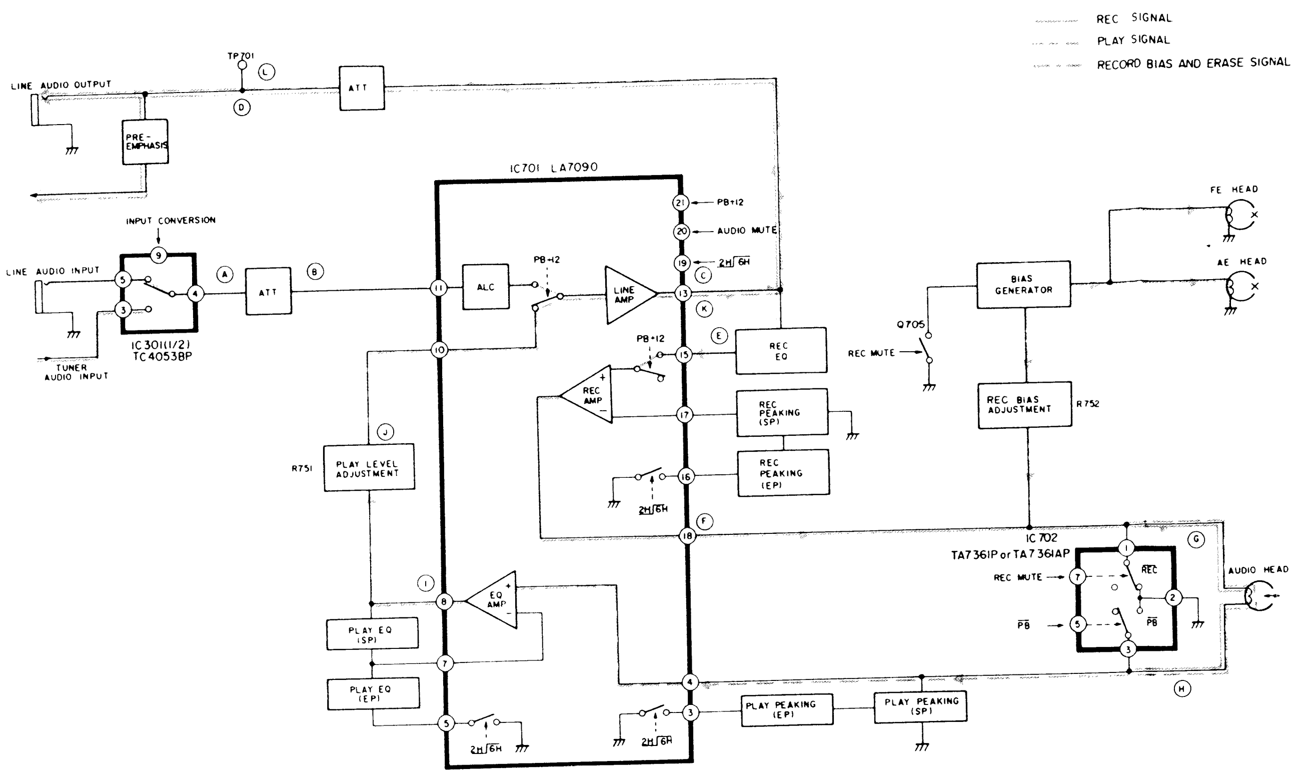

V: 0.2V/div.
H: 10μs/div.

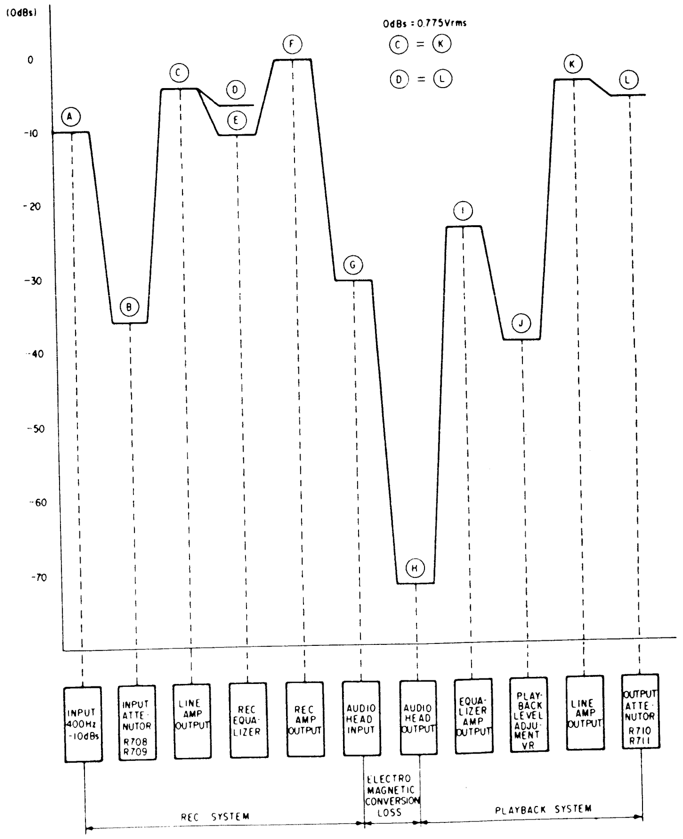

V: 0.1V/div.
H: 10μs/div.


V: 0.2V/div.
H: 10μs/div.


V: 50mV/div.
H: 0.1μs/div.

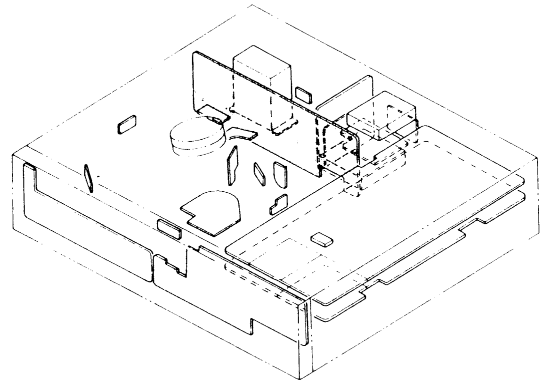
14-1. Audio Block Diagram


REC SIGNAL
PLAY SIGNAL
RECORD BIAS AND ERASE SIGNAL
LINE AUDIO OUTPUT
TP701
ATT
PRE-EMPHASIS
IC701 LA7090
PB+12
AUDIO MUTE
2H 6H
INPUT CONVERSION
LINE AUDIO INPUT
TUNER AUDIO INPUT
IC301(1/2) TC4053BP
ATT
ALC
LINE AMP
REC AMP
REC EQ
REC PEAKING (SP)
REC PEAKING (EP)
R751
PLAY LEVEL ADJUSTMENT
EQ AMP
PLAY EQ (SP)
PLAY EQ (EP)
PLAY PEAKING (EP)
PLAY PEAKING (SP)
Q705
REC MUTE
BIAS GENERATOR
REC BIAS ADJUSTMENT
R752
FE HEAD
AE HEAD
IC 702
TA7361P or TA7361AP
REC
PB
AUDIO HEAD

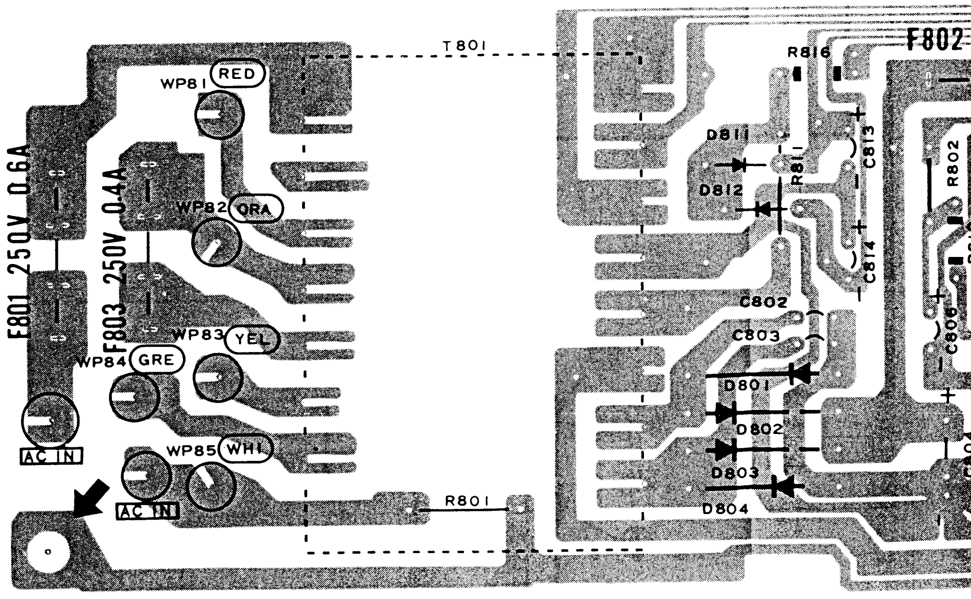


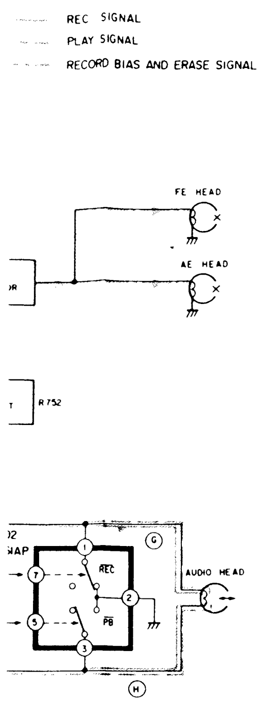
A
B
C
D
E
F
G

8-2. Power Supply PC Board

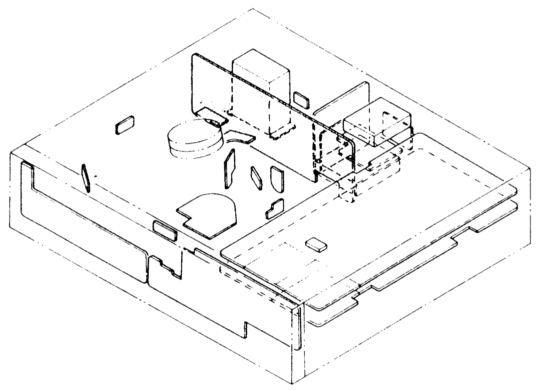


U802 Power 1 PC Board


T801
WP81 RED
WP82 ORA
WP83 YEL
WP84 GRE
WP85 WHI
F801 250V 0.6A
F803 250V 0.4A
AC IN
AC IN
R801
R816
F802
D811
D812
R811
C813
C814
R802
C802
C803
C806
D801
D802
D803
D804


REC SIGNAL
PLAY SIGNAL
RECORD BIAS AND ERASE SIGNAL
FE HEAD
AE HEAD
R752
REC
PB
AUDIO HEAD

8-2. Power Supply PC Board



Voltage and Location of Transistors

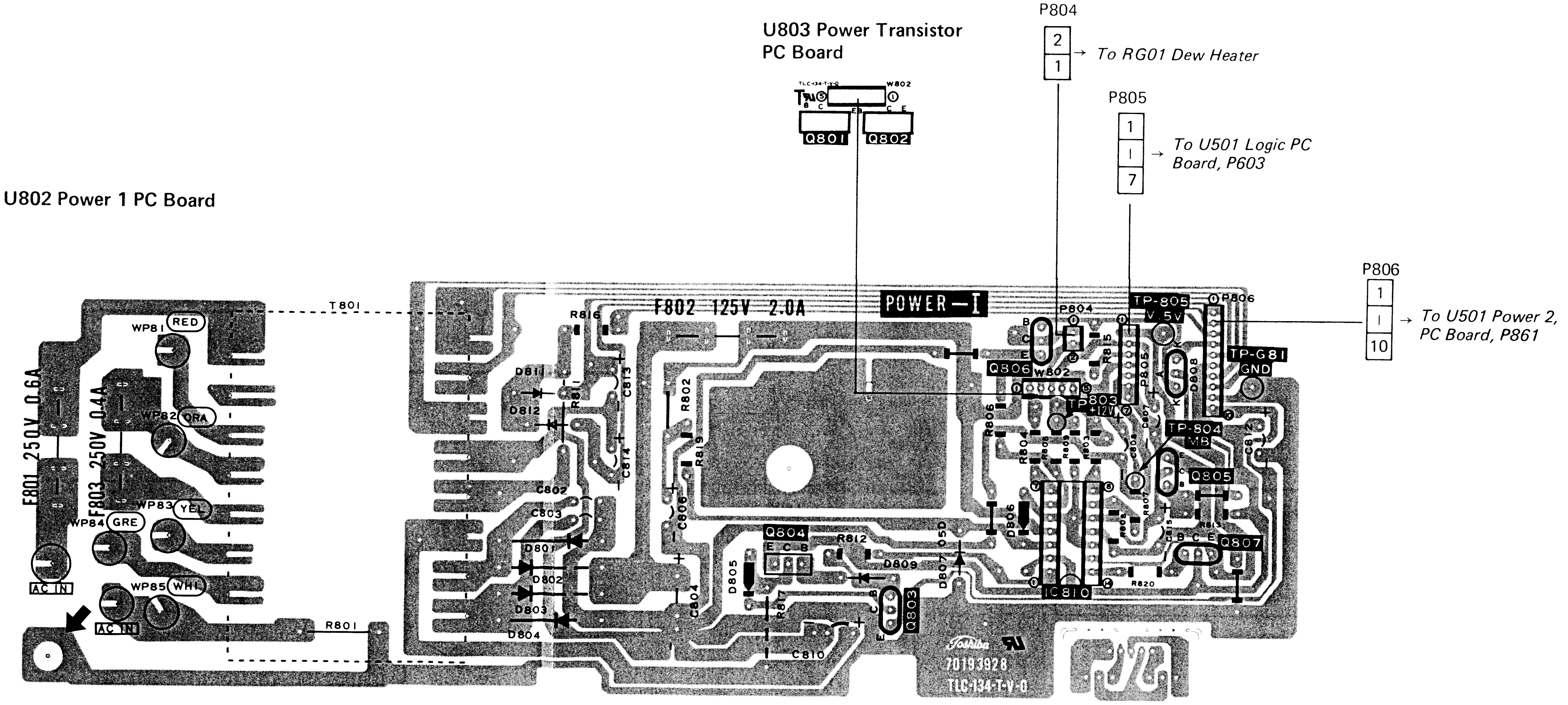
Symbol No.	Voltage (Unit: V)						Location
	E		C		B		
Q801	13.5	$\boxed{13.5}$	12.0		14.1	$\boxed{14.0}$	C-6
Q802	11.9	$\boxed{11.9}$	12.0		12.6	$\boxed{12.5}$	C-6
Q803	5.8	$\boxed{5.8}$	8.8	$\boxed{9.3}$	6.3	$\boxed{6.3}$	F-6
Q804	5.0	$\boxed{5.1}$	9.5	$\boxed{9.9}$	5.7	$\boxed{5.7}$	E-6
Q805	0		5.7	$\boxed{5.7}$	0.7	$\boxed{0.7}$	E-8
Q806	0		20.7	$\boxed{0.7}$	0.3	$\boxed{1.3}$	D-7
Q807	5.0	$\boxed{5.0}$	5.0	$\boxed{5.1}$	5.8	$\boxed{5.8}$	E-8

Location of Diodes

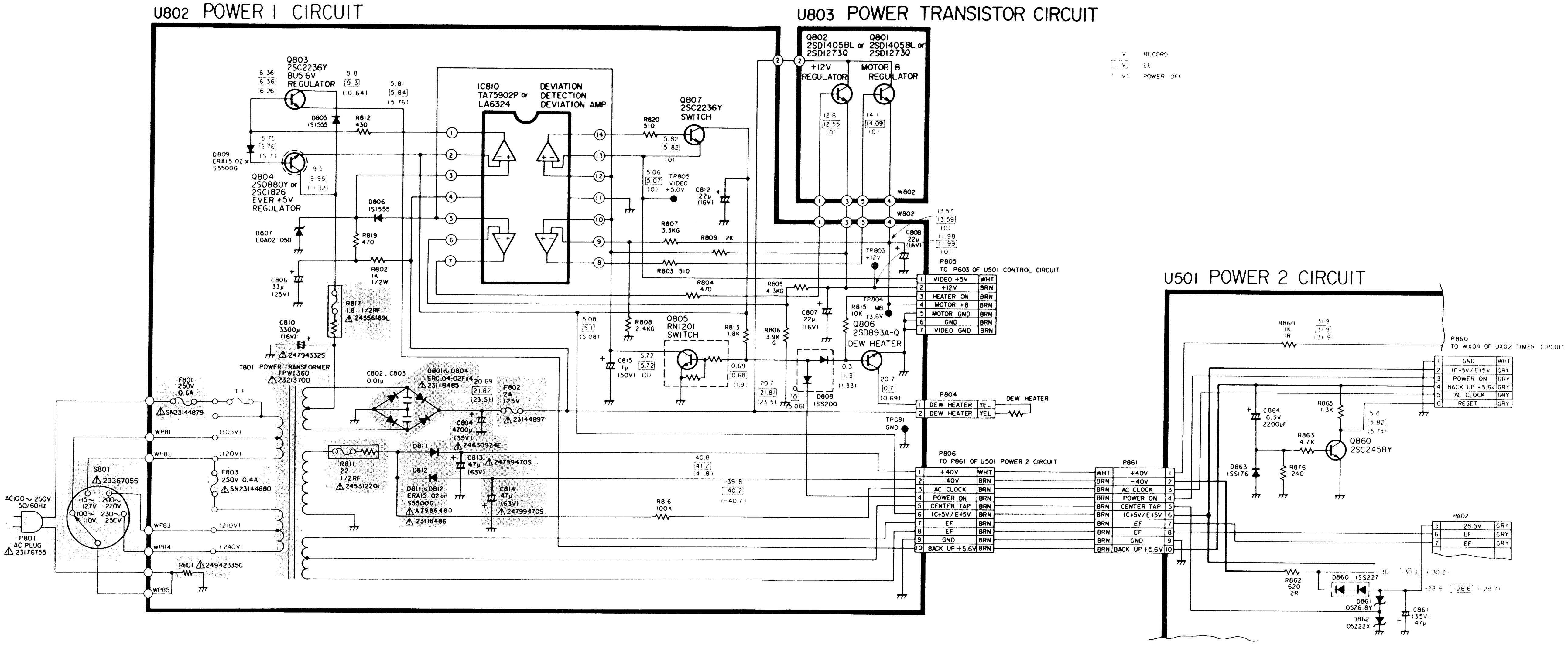
Symbol No.	Location
D801	E-5
D802	F-4
D803	F-4
D804	F-5
D805	F-6
D806	E-7
D807	E-7
D809	F-6
D811	E-4
D812	E-5

Location of IC

Symbol No.	Location
IC801	F-7


1 2 3 4 5 6 7 8 9 10
A B C D E F G
U803 Power Transistor PC Board
Q801
Q802
W802
P804
2
1
→ To RG01 Dew Heater
P805
1
7
→ To U501 Logic PC Board, P603
P806
1
10
→ To U501 Power 2, PC Board, P861
U802 Power 1 PC Board
T801
F802 125V 2.0A
POWER-I
F801 250V 0.6A
F803 250V 0.4A
WP81 RED
WP82 ORA
WP83 YEL
WP84 GRE
WP85 WHI
AC IN
AC IN
R801
R816
R811
R802
R819
R806
R815
R820
R817
R812
D801
D802
D803
D804
D805
D806
D807 05D
D808
D809
D811
D812
C802
C803
C804
C808
C810
C813
C814
Q803
Q804
Q805
Q806
Q807
IC810
TP-805 V 5V
TP-803
TP-804 MB
TP-G81 GND
P806
Toshiba
70193928
TLC-134-T-V-0

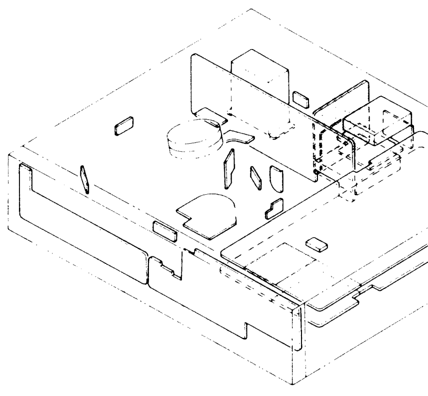
8-3. Power Supply Circuit


U802 POWER 1 CIRCUIT
U803 POWER TRANSISTOR CIRCUIT
U501 POWER 2 CIRCUIT
V RECORD
[V] EE
(V) POWER OFF
Q802 2SD1405BL or 2SD1273Q +12V REGULATOR
Q801 2SD1405BL or 2SD1273Q MOTOR B REGULATOR
Q803 2SC2236Y BU5.6V REGULATOR
Q804 2SD880Y or 2SC1826 EVER +5V REGULATOR
IC810 TA75902P or LA6324 DEVIATION DETECTION DEVIATION AMP
Q807 2SC2236Y SWITCH
Q805 RN1201 SWITCH
Q806 2SD893A-Q DEW HEATER
Q860 2SC2458Y
T801 POWER TRANSFORMER TPW1360 ⚠23213700
S801 ⚠23367055
P801 AC PLUG ⚠23176755
AC100~250V 50/60Hz
F801 250V 0.6A ⚠SN23144879
F802 2A 125V ⚠23144897
F803 250V 0.4A ⚠SN23144880
D801~D804 ERC04-02Fx4 ⚠23118485
D811~D812 ERA15 02 or S5500G ⚠A7986480 ⚠23118486
W802
P805 TO P603 OF U501 CONTROL CIRCUIT
1 VIDEO +5V WHT
2 +12V BRN
3 HEATER ON BRN
4 MOTOR +B BRN
5 MOTOR GND BRN
6 GND BRN
7 VIDEO GND BRN
P804
1 DEW HEATER YEL
2 DEW HEATER YEL
DEW HEATER
TPG81 GND
P806 TO P861 OF U501 POWER 2 CIRCUIT
1 +40V WHT
2 −40V BRN
3 AC CLOCK BRN
4 POWER ON BRN
5 CENTER TAP BRN
6 IC+5V/E+5V BRN
7 EF BRN
8 EF BRN
9 GND BRN
10 BACK UP +5.6V BRN
P861
P860 TO WX04 OF UX02 TIMER CIRCUIT
1 GND WHT
2 IC+5V/E+5V GRY
3 POWER ON GRY
4 BACK UP +5.6V GRY
5 AC CLOCK GRY
6 RESET GRY
PA02
5 −28.5V GRY
6 EF GRY
7 EF GRY
D860 1SS227
D861 05Z6.8Y
D862 05Z22X
D863 1SS176
C861 (35V) 47μ
C864 6.3V 2200μF

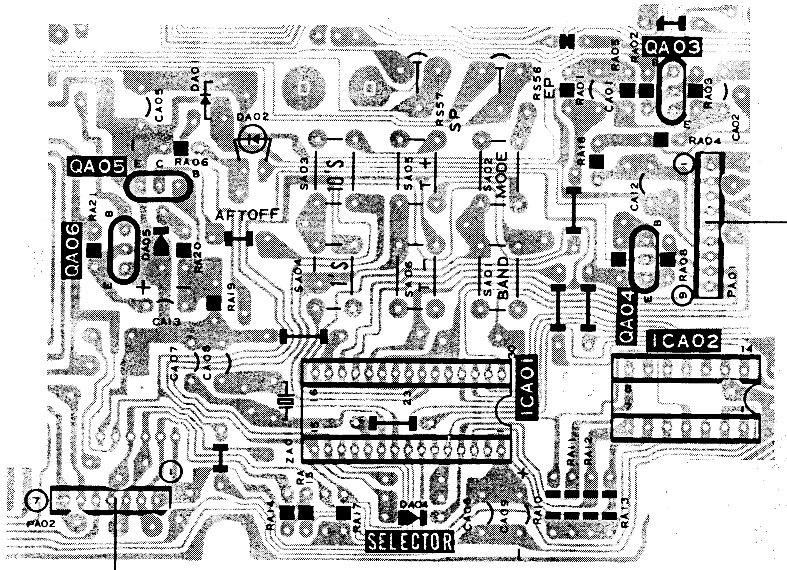
1 2 3 4 5 6 7 8 9 10 11

A B C D E F G

9-2. PIF PC Board



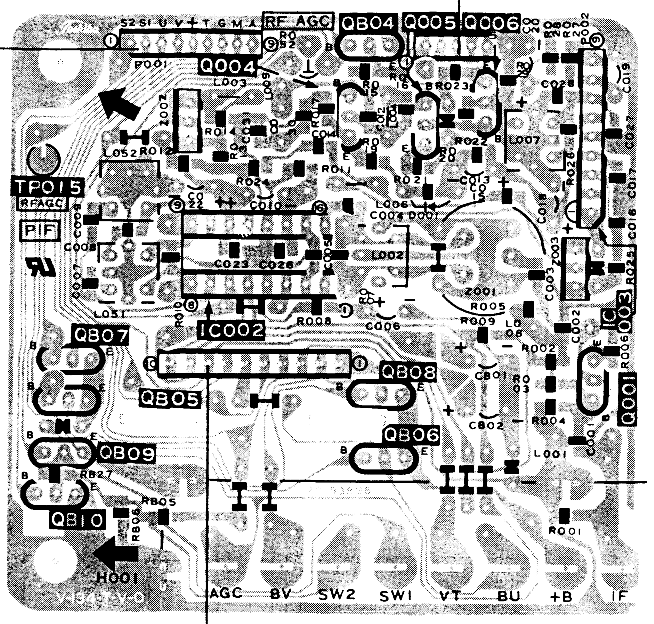
U501 CHANNEL SELECTOR PC BOARD


QA03
QA05
QA06
QA04
AFT OFF
ICA01
ICA02
SP
EP
MODE
BAND
SELECTOR
PA02

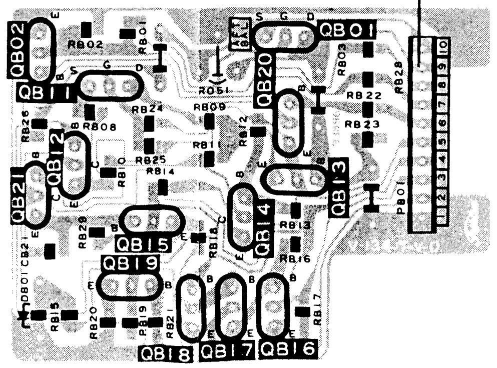
PA02
7 – 1 → *To UX01 Timer PC Board, WX02*

U102 PIF PC BOARD

P002
1 – 5 → *To U101 Video PC Board, P203*


RF AGC
QB04
Q005
Q006
Q004
TP015
RFAGC
PIF
IC002
QB07
QB05
QB08
QB06
QB09
QB10
H001
IC003
Q001
AGC
BV
SW2
SW1
VT
BU
+B
IF

U003 AFT PC BOARD


QB01
QB02
QB11
QB12
QB20
QB21
QB13
QB14
QB15
QB19
QB18
QB17
QB16

Band Switch

Symbol No.	Voltage (Unit: V)												Location
	V_L			V_H			U			CATV			
	E	C	B	E	C	B	E	C	B	E	C	B	
QB05	0	12	0	0	12	0	0	0	5	0	12	0	C-7
QB06	12	0	12	12	0	12	12	12	0	12	0	12	C-8
QB07	0	0	5	0	0	5	0	12	0	0	0	5	C-6
QB08	12	12	0	12	12	0	12	0	12	12	12	0	C-8
QB09	0	24	0	0	0	5	0	24	0	0	0	5	C-6
QB10	0	24	0	0	24	0	0	24	0	0	0	5	D-6

Location of Diodes

Symbol No.	Location
D001	C-8
DA02	C-2
DA04	E-3
DA05	D-2
DB01	G-5

Location of ICs

Symbol No.	Location
IC002	C-7
IC003	C-8
ICA01	D-4
ICA02	D-4

Location of VRs

Symbol No.	Location
R051	F-6
R052	B-7
RS56	C-4
RS57	C-3

Voltage and Location of Transistors

Symbol No.	Voltage (Unit: V)			Location
	E(S)	C(D)	B(G)	
Q001	0.5	7.3	1.2	C-8
Q004	2.5	7.3	3.2	B-7
Q005	7.7	1.5	7.3	B-8
Q006	2.2	0	1.5	B-8
QA03	0	5	0.5	C-4
QA05	0	4.5	0	D-2
QA06	0	0	0	D-2
QB10				D-6
QB11	7.0	7.2		F-5
QB12	7.1	1.4	6.5	G-5
QB13	7.2	0	6.5	G-6
QB14	24.5	20.6	23.8	G-6
QB15	11.4	32	11.9	G-6
QB16	8.3	31.4	8.8	G-6
QB17	8.8	0	8.2	G-6
QB18	0.7	8.2	1.4	G-6
QB19	0.6	0.7	1.2	G-6
QB20	0	0.8	0	F-6
QB21	12	0	11.3	G-5
Q860	0	5.8 (5.8)	0 (0)	
Q861	0	0 (0)	0.6 (0.6)	

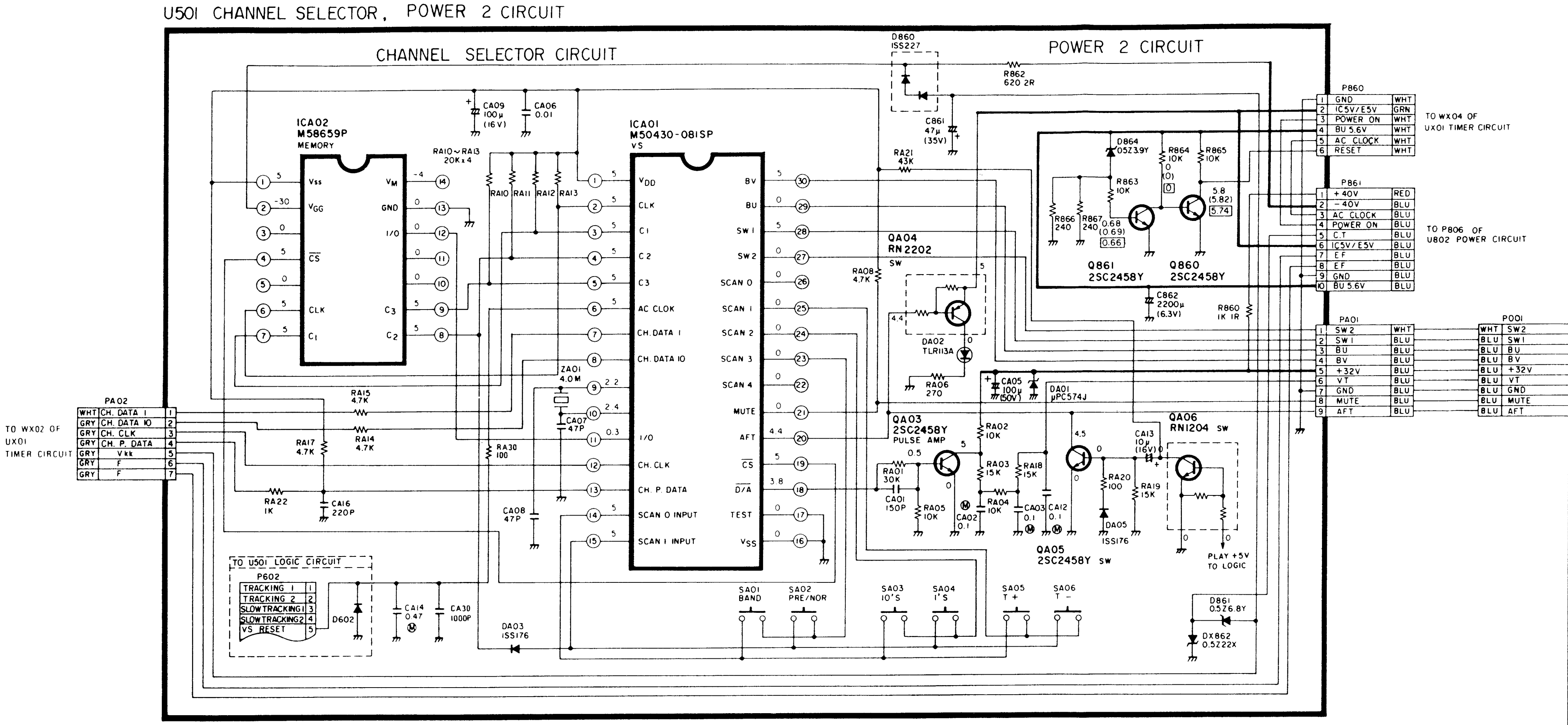
AFT Defeat

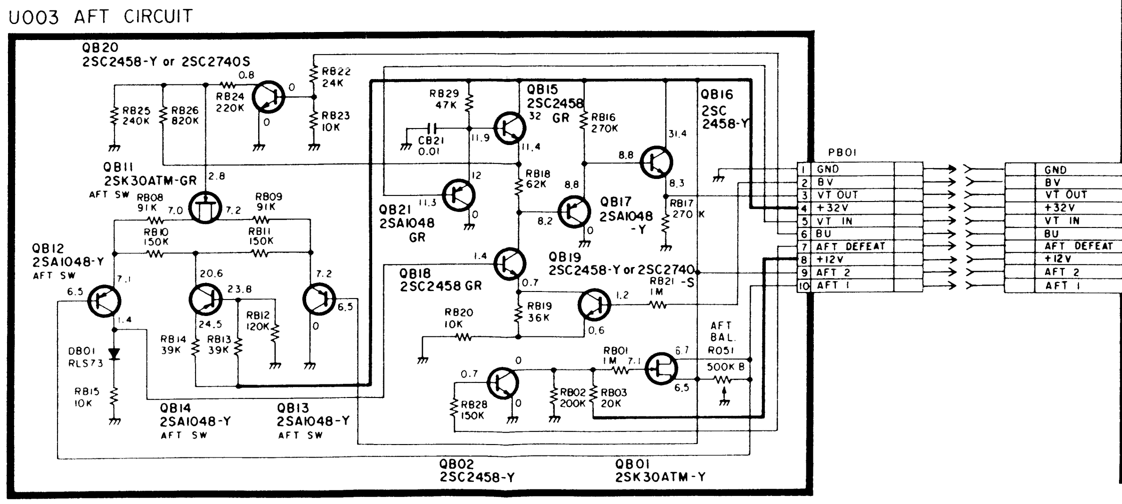
Symbol No.	Voltage (Unit: V)						Location
	AFT ON			AFT OFF			
	E(S)	C(D)	B(G)	E(S)	C(D)	B(G)	
QA04	5	1.0	4.4	5	4.4	0	D-4
QB01	6.7	6.5	7.1	6.6	6.7	0	F-6
QB02	0	0	0.7	0	11	0	F-5

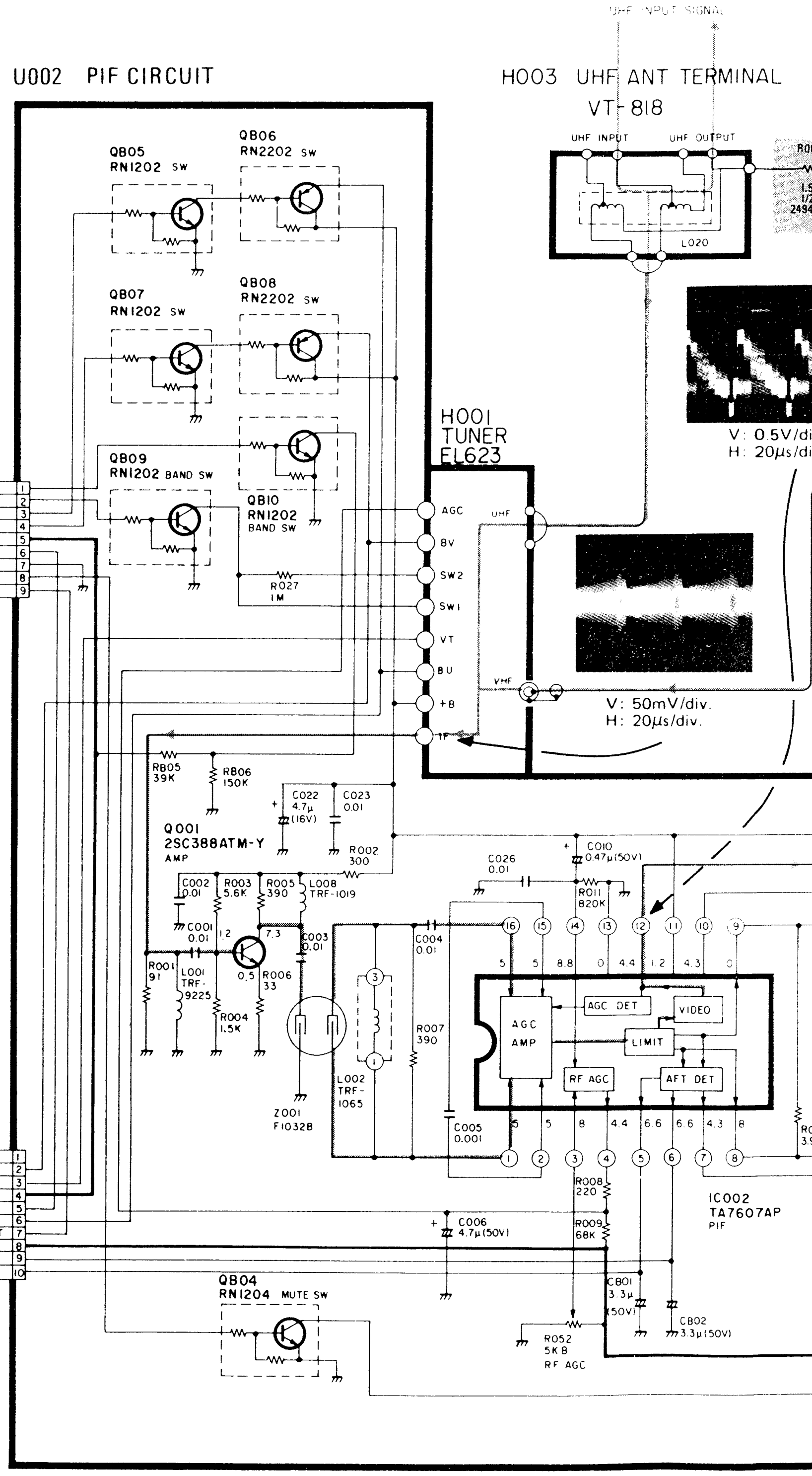
Semi-conductor
QB04 Audio Mute

Mode	Voltage (Unit: V)			Location
	E	C	B	
Mute ON	0	0	5	B-7
Mute OFF	0	0	0	

9-3. PIF Circuit


U501 CHANNEL SELECTOR, POWER 2 CIRCUIT
CHANNEL SELECTOR CIRCUIT
POWER 2 CIRCUIT
ICA02 M58659P MEMORY
ICA01 M50430-081SP VS
RA10~RA13 20K×4
CA09 100μ (16V)
CA06 0.01
QA04 RN2202 SW
QA03 2SC2458Y PULSE AMP
QA05 2SC2458Y SW
QA06 RN1204 SW
DA01 μPC574J
DA02 TLR113A
Q861 2SC2458Y
Q860 2SC2458Y
D860 1SS227
D864 05Z39Y
C861 47μ (35V)
C862 2200μ (6.3V)
R862 620 2R
RA21 43K
P860
P861
PA01
PA02
P001
P602
TO WX02 OF UX01 TIMER CIRCUIT
TO WX04 OF UX01 TIMER CIRCUIT
TO P806 OF U802 POWER CIRCUIT
TO U501 LOGIC CIRCUIT
PLAY +5V TO LOGIC
SA01 BAND
SA02 PRE/NOR
SA03 10'S
SA04 1'S
SA05 T+
SA06 T−
CH. DATA I
CH. DATA 10
CH. CLK
CH. P. DATA
Vkk
TRACKING 1
TRACKING 2
SLOW TRACKING 1
SLOW TRACKING 2
VS RESET
GND
IC5V/E5V
POWER ON
BU 5.6V
AC CLOCK
RESET
+40V
−40V
C.T
EF
SW2
SW1
BU
BV
+32V
VT
MUTE
AFT


U003 AFT CIRCUIT
QB20 2SC2458-Y or 2SC2740S
QB11 2SK30ATM-GR AFT SW
QB12 2SA1048-Y AFT SW
QB14 2SA1048-Y AFT SW
QB13 2SA1048-Y AFT SW
QB15 2SC2458 GR
QB16 2SC 2458-Y
QB17 2SA1048 -Y
QB18 2SC2458 GR
QB19 2SC2458-Y or 2SC2740 -S
QB21 2SA1048 GR
QB02 2SC2458-Y
QB01 2SK30ATM-Y
DB01 RLS73
AFT BAL R051 500K B
PB01
GND
BV
VT OUT
+32V
VT IN
BU
AFT DEFEAT
+12V
AFT 2
AFT 1


U002 PIF CIRCUIT
H003 UHF ANT TERMINAL VT-818
UHF INPUT SIGNAL
UHF INPUT
UHF OUTPUT
L020
H001 TUNER EL623
AGC
BV
SW2
SW1
VT
BU
+B
IF
UHF
VHF
V: 0.5V/div
H: 20μs/div
V: 50mV/div.
H: 20μs/div.
QB05 RN1202 SW
QB06 RN2202 SW
QB07 RN1202 SW
QB08 RN2202 SW
QB09 RN1202 BAND SW
QB10 RN1202 BAND SW
QB04 RN1204 MUTE SW
Q001 2SC388ATM-Y AMP
Z001 F1032B
L001 TRF-9225
L002 TRF-1065
L008 TRF-1019
IC002 TA7607AP PIF
AGC AMP
AGC DET
VIDEO
LIMIT
RF AGC
AFT DET
R052 5K B RF AGC

BAND SWITCH

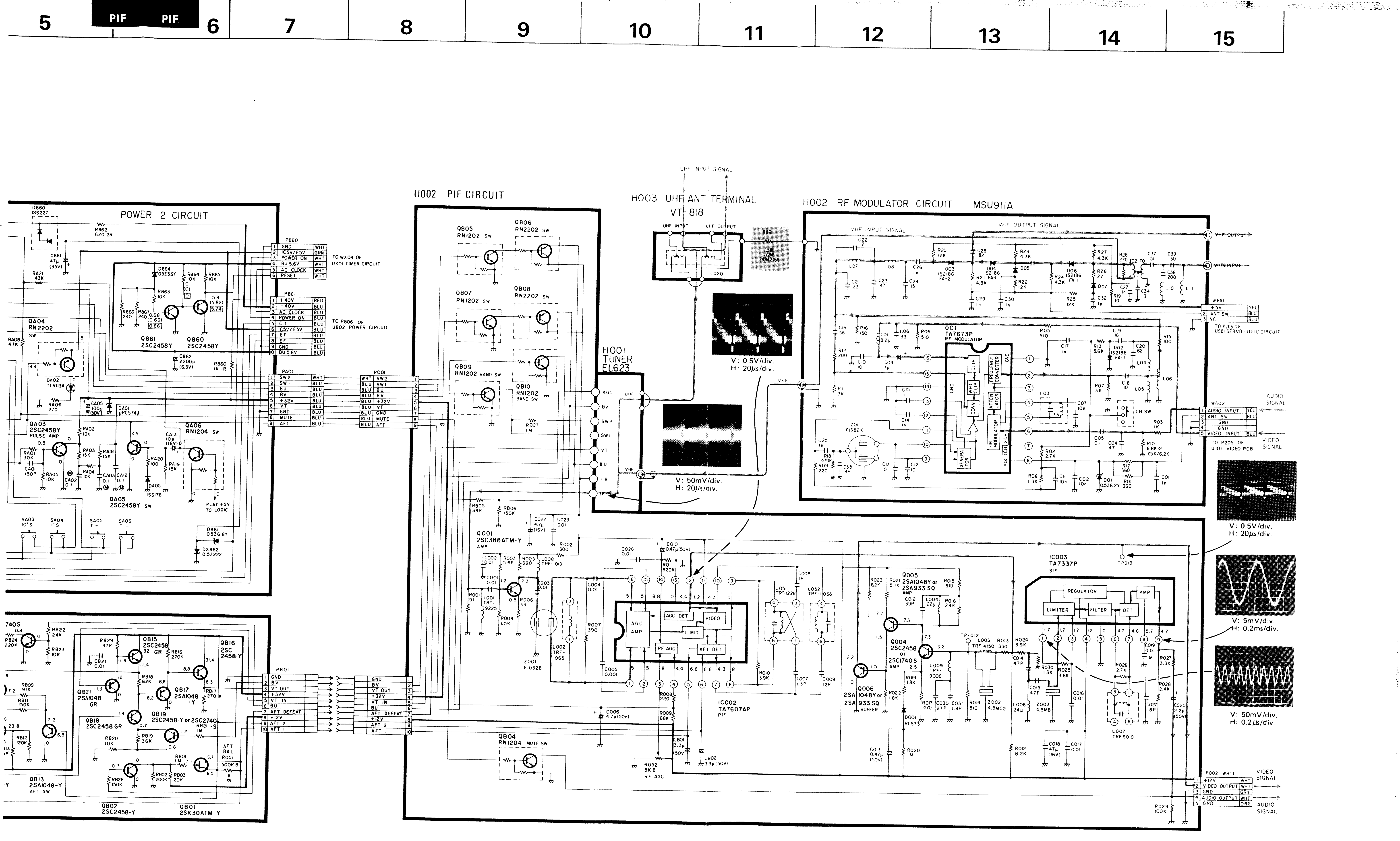
SYMBOL NO.	VOLTAGE (UNIT: V)											
	VL			VH			U			CATV		
	E	C	B	E	C	B	E	C	B	E	C	B
QB05	0	12	0	0	12	0	0	0	5	0	12	0
QB06	12	0	12	12	0	12	12	12	0	12	0	12
QB07	0	0	5	0	0	5	0	12	0	0	0	5
QB08	12	12	0	12	12	0	12	0	12	12	12	0
QB09	0	24	0	0	0	5	0	24	0	0	0	5
QB10	0	24	0	0	24	0	0	24	0	0	0	5

AFT DEFEAT

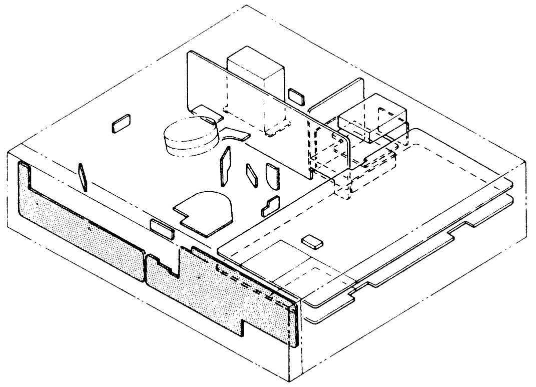
Symbol No.	Voltage (Unit: V)					
	AFT ON			AFT OFF		
	E(S)	C(D)	B(G)	E(S)	C(D)	B(G)
QA04	5	1.0	4.4	5	4.4	0
QB01	6.7	6.5	7.1	6.6	6.7	0
QB02	0	0	0.7	0	11	0

SEMI-CONDUCTOR
QB04 AUDIO MUTE

MODE	VOLTAGE (UNIT: V)		
	E	C	B
MUTE ON	0	0	5
MUTE OFF	0	0	0


5
PIF
PIF
6
7
8
9
10
11
12
13
14
15
POWER 2 CIRCUIT
P860
GND
IC5V/E5V
POWER ON
BU 5.6V
AC CLOCK
RESET
TO WX04 OF UX01 TIMER CIRCUIT
P861
+40V
-40V
AC CLOCK
POWER ON
C.T
IC5V/E5V
EF
EF
GND
BU 5.6V
TO P806 OF U802 POWER CIRCUIT
Q861 2SC2458Y
Q860 2SC2458Y
QA04 RN2202
QA03 2SC2458Y PULSE AMP
QA05 2SC2458Y SW
QA06 RN1204 SW
DA01 μPC574J
DA02 TLR113A
PA01
SW2
SW1
BU
BV
+32V
VT
GND
MUTE
AFT
P001
PLAY +5V TO LOGIC
SA03 10'S
SA04 1'S
SA05 T+
SA06 T−
U002 PIF CIRCUIT
QB05 RN1202 SW
QB06 RN2202 SW
QB07 RN1202 SW
QB08 RN2202 SW
QB09 RN1202 BAND SW
QB10 RN1202 BAND SW
H001 TUNER EL623
AGC
BV
SW2
SW1
VT
BU
+B
TP
UHF
VHF
H003 UHF ANT TERMINAL VT-818
UHF INPUT SIGNAL
UHF INPUT
UHF OUTPUT
R061 LSM 1/2W 24942155
V: 0.5V/div.
H: 20μs/div.
V: 50mV/div.
H: 20μs/div.
H002 RF MODULATOR CIRCUIT MSU911A
VHF INPUT SIGNAL
VHF OUTPUT SIGNAL
VHF OUTPUT
VHF INPUT
QC1 TA7673P RF MODULATOR
CLIP
WHT CLIP
FREQUENCY CONVERTER
CONV.
ATTEN UATION
M. MODULATOR
GENERA TOR
W610
+5V
ANT SW
NC
TO P205 OF U501 SERVO LOGIC CIRCUIT
W402
AUDIO INPUT
ANT SW
GND
GND
VIDEO INPUT
TO P205 OF U101 VIDEO PCB
AUDIO SIGNAL
VIDEO SIGNAL
CH.SW
Z01 F1382K
Q001 2SC388ATM-Y AMP
IC002 TA7607AP PIF
AGC AMP
AGC DET
VIDEO
LIMIT
RF AGC
AFT DET
Z001 F1032B
Q005 2SA1048Y or 2SA933 SQ AMP
Q004 2SC2458 or 2SC1740S AMP
Q006 2SA1048Y or 2SA 933 SQ BUFFER
IC003 TA7337P SIF
REGULATOR
AMP
LIMITER
FILTER
DET
TP013
TP-012
QB04 RN1204 MUTE SW
R052 5K B RF AGC
V: 0.5V/div.
H: 20μs/div.
V: 5mV/div.
H: 0.2ms/div.
V: 50mV/div.
H: 0.2μs/div.
P002 (WHT)
+12V
VIDEO OUTPUT
GND
AUDIO OUTPUT
GND
VIDEO SIGNAL
AUDIO SIGNAL
PB01
GND
BV
VT OUT
+32V
VT IN
BU
AFT DEFEAT
+12V
AFT 2
AFT 1
QB15 2SC2458 GR
QB16 2SC2458-Y
QB17 2SA1048-Y
QB18 2SC2458 GR
QB19 2SC2458-Y or 2SC2740-S
QB21 2SA1048 GR
QB13 2SA1048-Y AFT SW
QB02 2SC2458-Y
QB01 2SK30ATM-Y
AFT BAL.

10-2. Timer, Counter PC Board



Location of Diodes

Symbol No.	Location
DL01	B-15
DL02	B-8
DL05	G-6
DL07	G-4
DR01	A-13
DX01	C-12
DX02	C-16
DX03	B-16
DX04	B-16
DX07	B-16
DX09	B-12
DX10	A-9
DX11	C-11
DX12	C-9
DX13	D-10
DX14	B-9
DX15	B-8
DX16	F-4
DX17	F-4
DX18	G-2

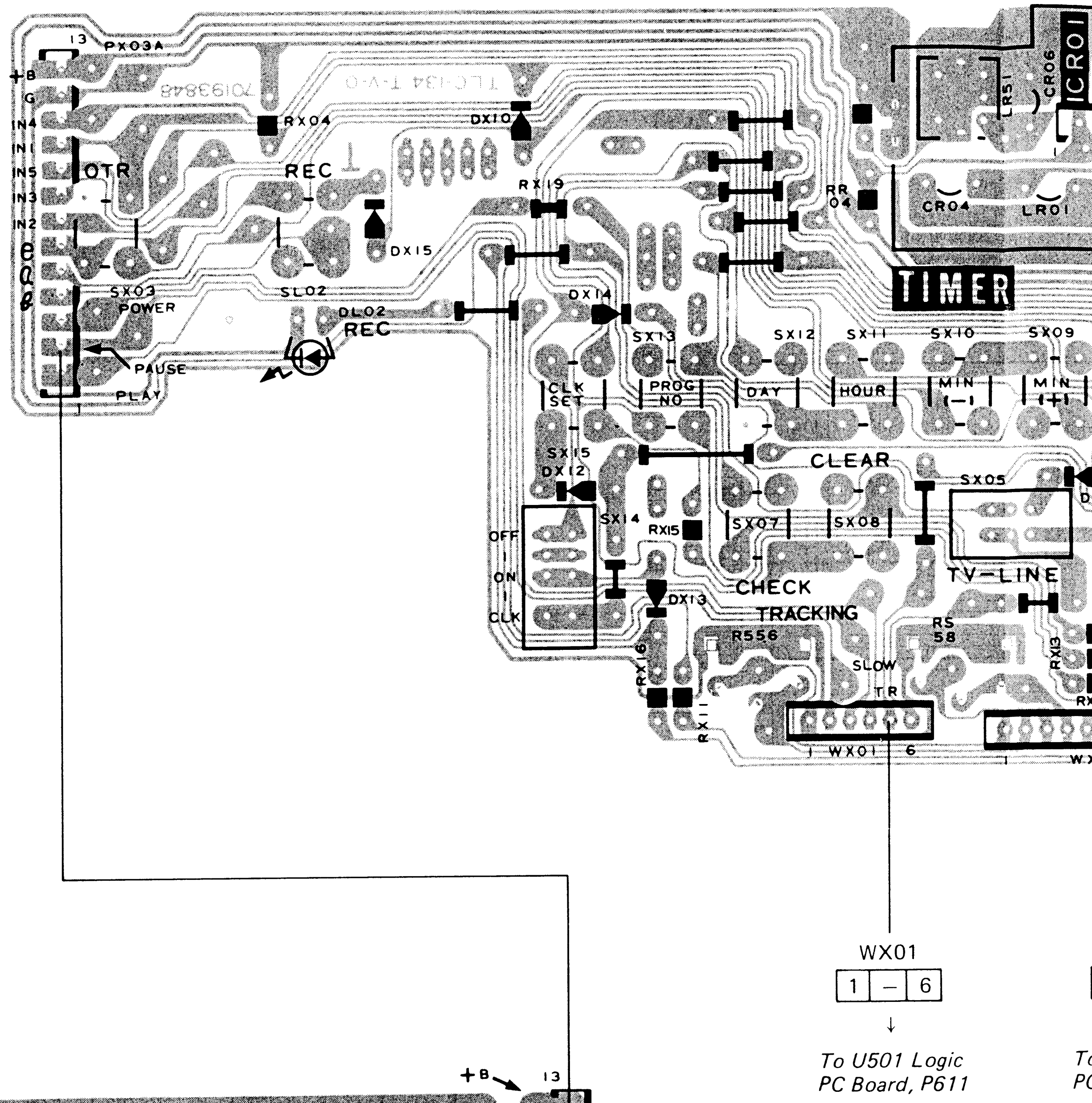
Location of ICs

Symbol No.	Location
ICR01	A-11
ICX01	C-14

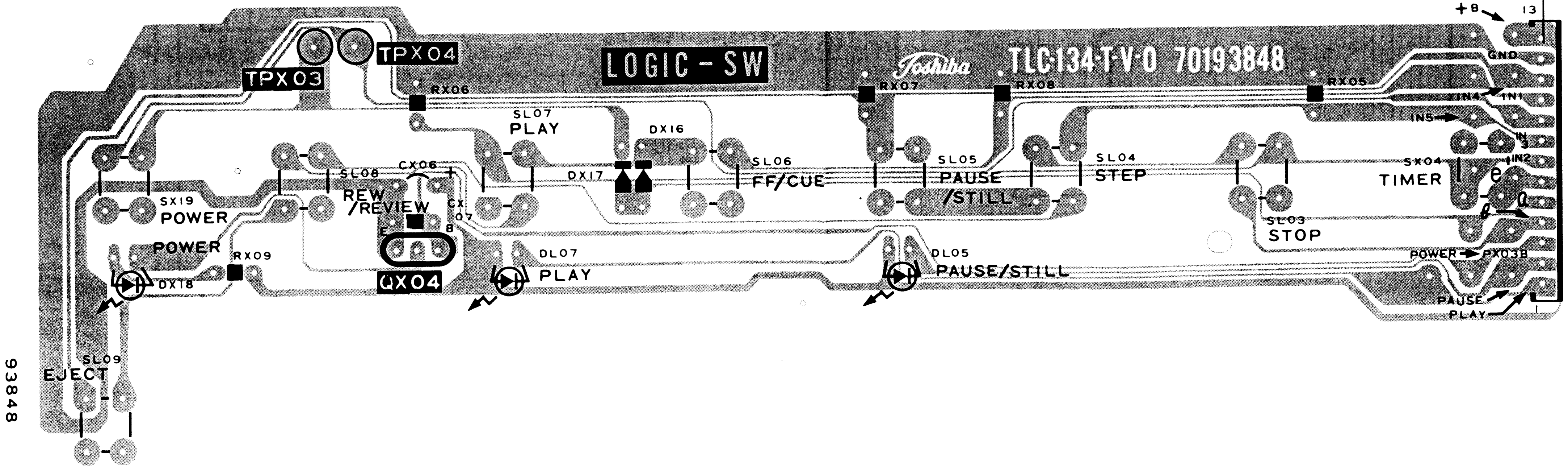
Voltage and Location of Transistors

Symbol No.	Voltage (Unit: V)			Location
	E	C	B	
QX02		5.0		C-13
QX03	0.0	0.0	5.6	C-13
QX04	0.0	0.1	5.5	G-3

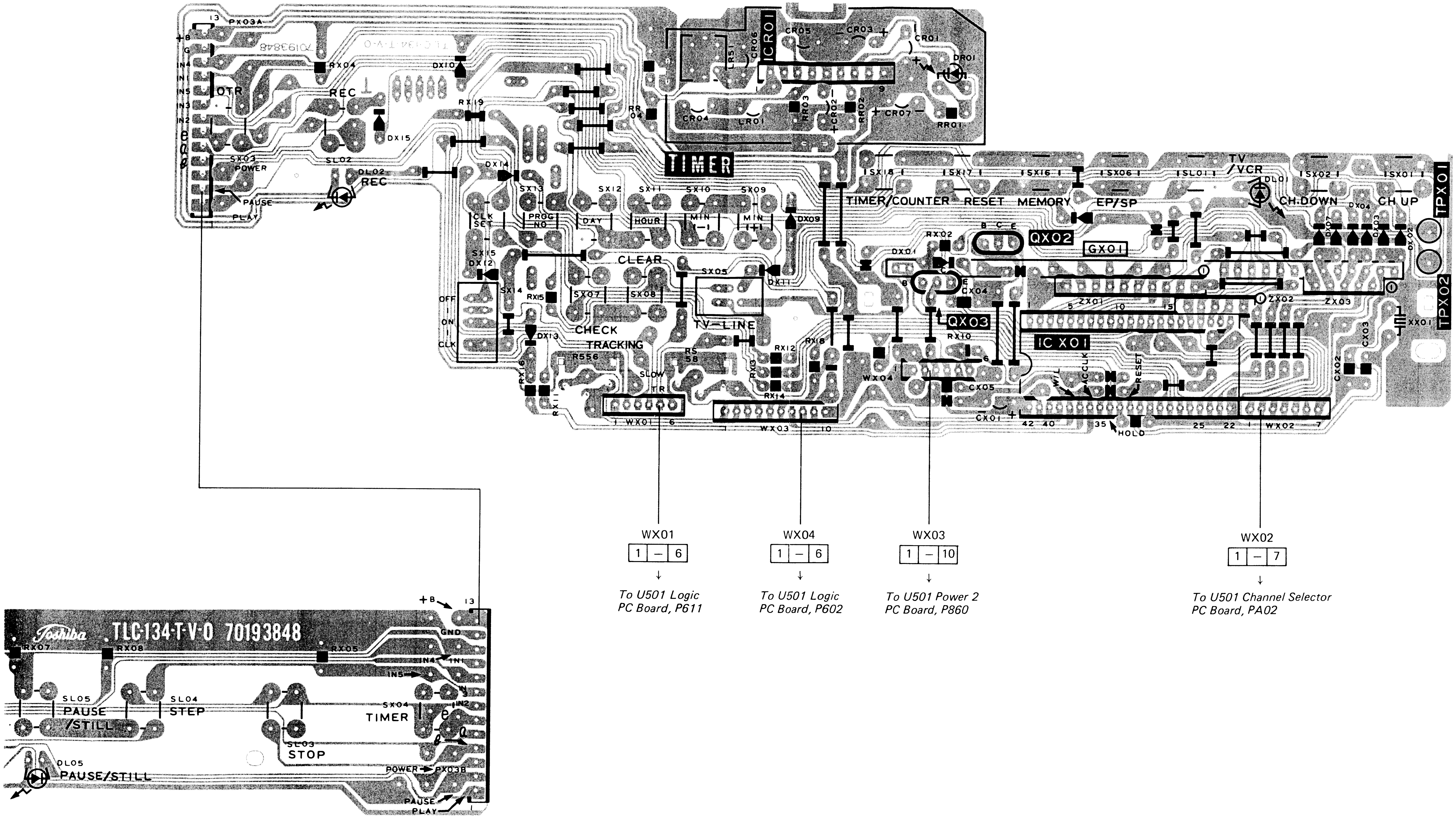
UX01 TIMER PC BOARD


13
PX03A
+B
G
IN4
IN1
IN5
IN3
IN2
OTR
RX04
REC
DX10
RX19
DX15
RR 04
ICR01
CR06
LR51
CR04
LR01
TIMER
SX03 POWER
PAUSE
PLAY
SL02
DL02 REC
DX14
SX13
SX12
SX11
SX10
SX09
CLK SET
PROG NO
DAY
HOUR
MIN (–)
MIN (+)
SX15
DX12
CLEAR
SX05
SX14
RX15
SX07
SX08
OFF
ON
CLK
CHECK
TV-LINE
DX13
TRACKING
R556
RS 58
SLOW
TR
RX16
RX13
RX11
1 WX01 6
WX01
1 – 6
To U501 Logic PC Board, P611
To PC

UL01 LOGIC SWITCH PC BOARD


TPX04
TPX03
LOGIC - SW
Toshiba
TLC-134-T-V-0 70193848
RX06
RX07
RX08
RX05
+B
13
GND
IN4
IN1
IN5
IN3
IN2
SL07 PLAY
DX16
DX17
SL06 FF/CUE
SL05 PAUSE /STILL
SL04 STEP
SX04 TIMER
SX19 POWER
SL08 REW /REVIEW
CX06
CX07
E
B
POWER
RX09
DX18
QX04
DL07 PLAY
DL05 PAUSE/STILL
SL03 STOP
POWER
PX03B
PAUSE
PLAY
1
SL09 EJECT
93848

UX01 TIMER PC BOARD


TLC-134-T-V-0 70193848
Toshiba
PX03A
PX03B
+B
13
GND
IN4
IN1
IN5
IN3
IN2
OTR
REC
DX10
DX15
RX04
RX19
SX03
POWER
PAUSE
PLAY
SL02
DL02
REC
DX14
SX13
SX12
SX11
SX10
SX09
CLK SET
PROG NO
DAY
HOUR
MIN -1
MIN +1
DX09
SX15
DX12
CLEAR
SX05
DX11
SX14
RX15
SX07
SX08
OFF
ON
CLK
DX13
CHECK
TRACKING
TV-LINE
RX16
RX11
R556
SLOW
TR
RS 58
RX13
RX12
RX18
RX14
WX01
WX03
WX04
CR01
CR05
CR03
CR06
LR51
IC R01
DR01
RR04
CR04
LR01
RR03
CR02
RR02
CR07
RR01
TIMER
SX18
SX17
SX16
SX06
SL01
SX02
SX01
TV /VCR
DL01
TIMER/COUNTER
RESET
MEMORY
EP/SP
CH.DOWN
CH.UP
TPX01
TPX02
RX02
B C E
QX02
GX01
DX01
DX07
DX04
DX03
DX02
CX04
ZX01
ZX02
ZX03
QX03
RX10
IC XO1
XX01
CX03
CX02
CX05
CX01
W/L
ACCLK
RESET
HOLD
WX02
42 40 35 25 22 1 7
SL05
PAUSE /STILL
SL04
STEP
SX04
TIMER
SL03
STOP
DL05
PAUSE/STILL
RX07
RX08
RX05
POWER
PAUSE
PLAY

WX01
1 – 6
↓
To U501 Logic PC Board, P611

WX04
1 – 6
↓
To U501 Logic PC Board, P602

WX03
1 – 10
↓
To U501 Power 2 PC Board, P860

WX02
1 – 7
↓
To U501 Channel Selector PC Board, PA02

A

10-3. Timer, Counter Circuit

B

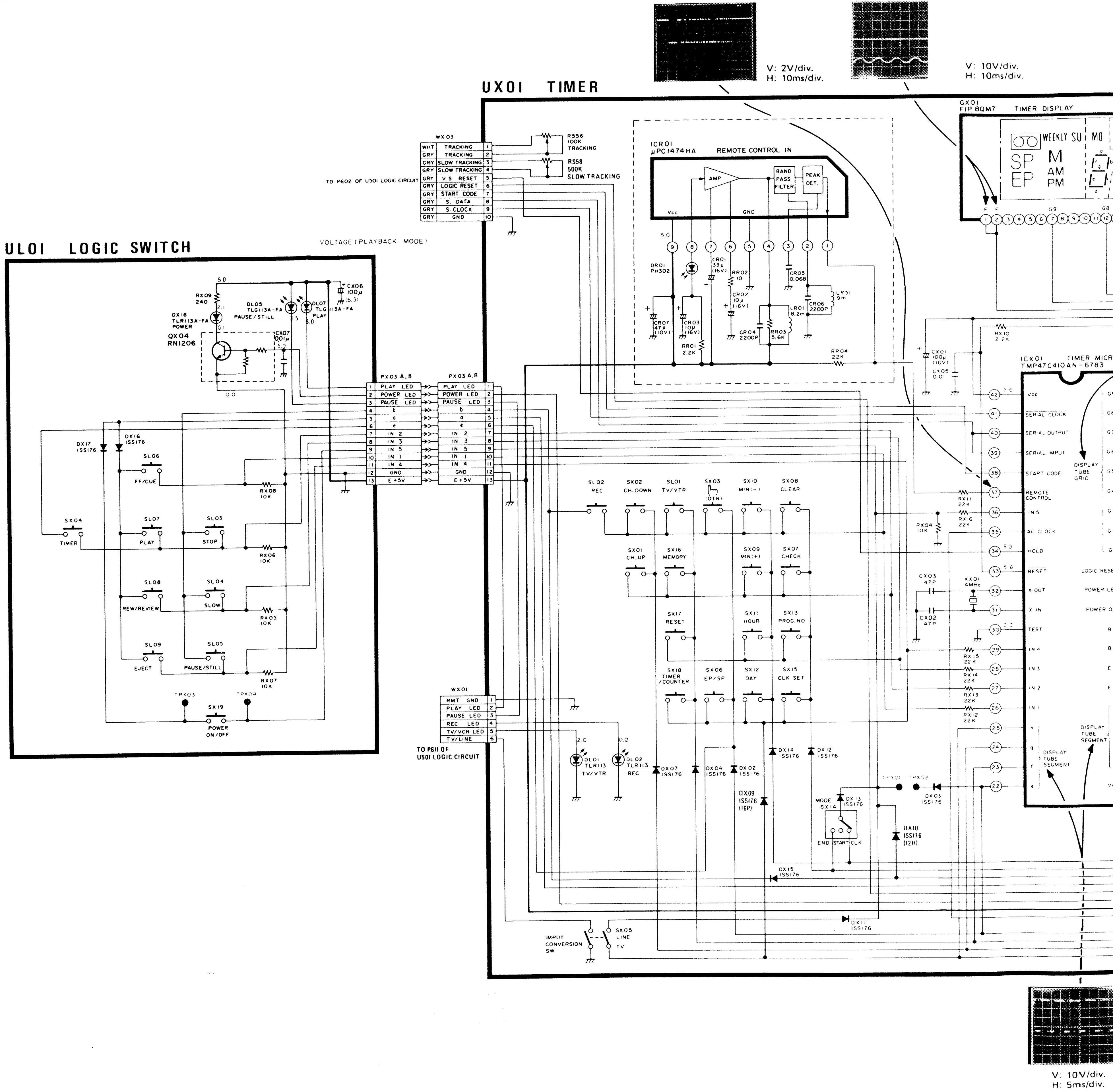
C

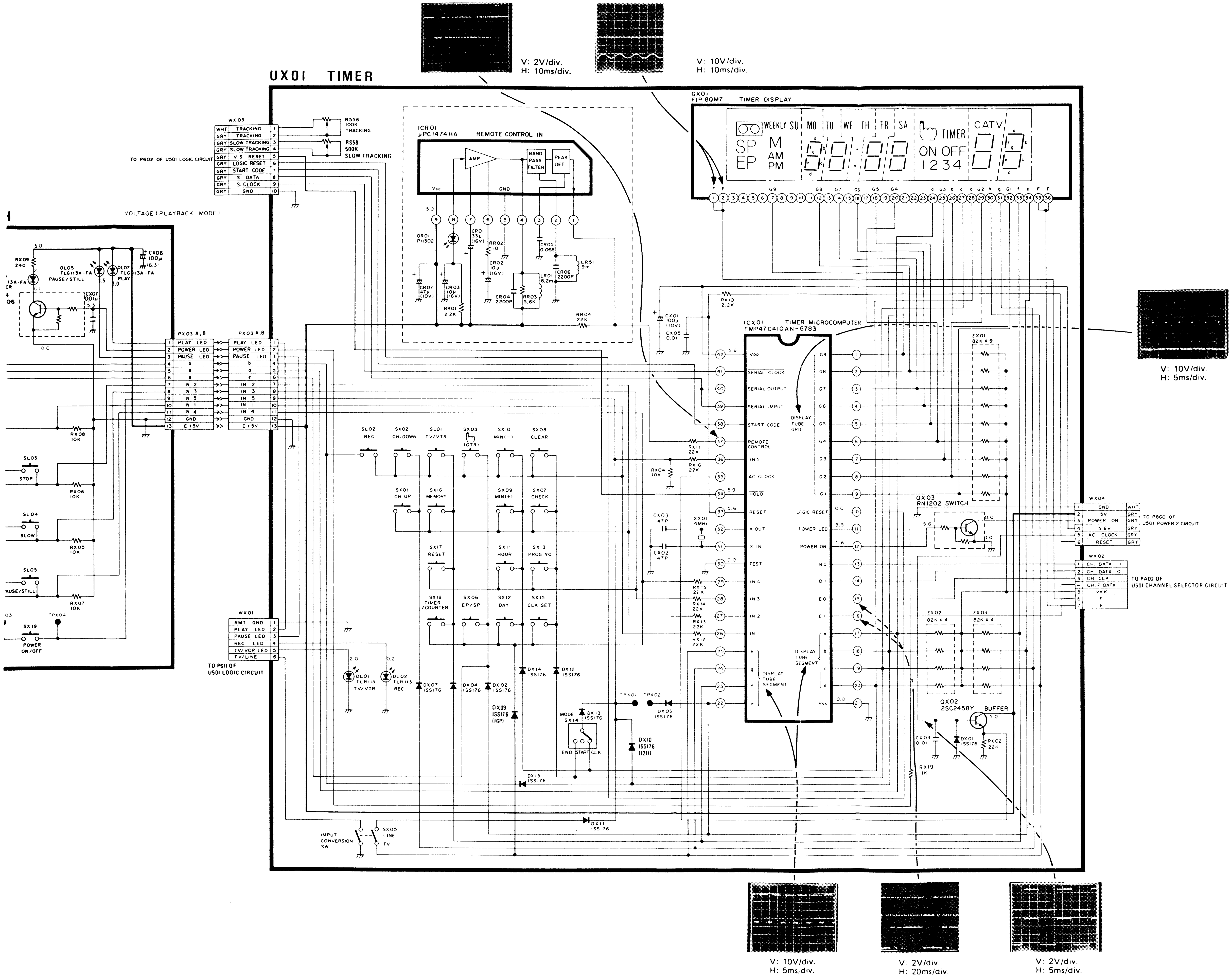
D

E

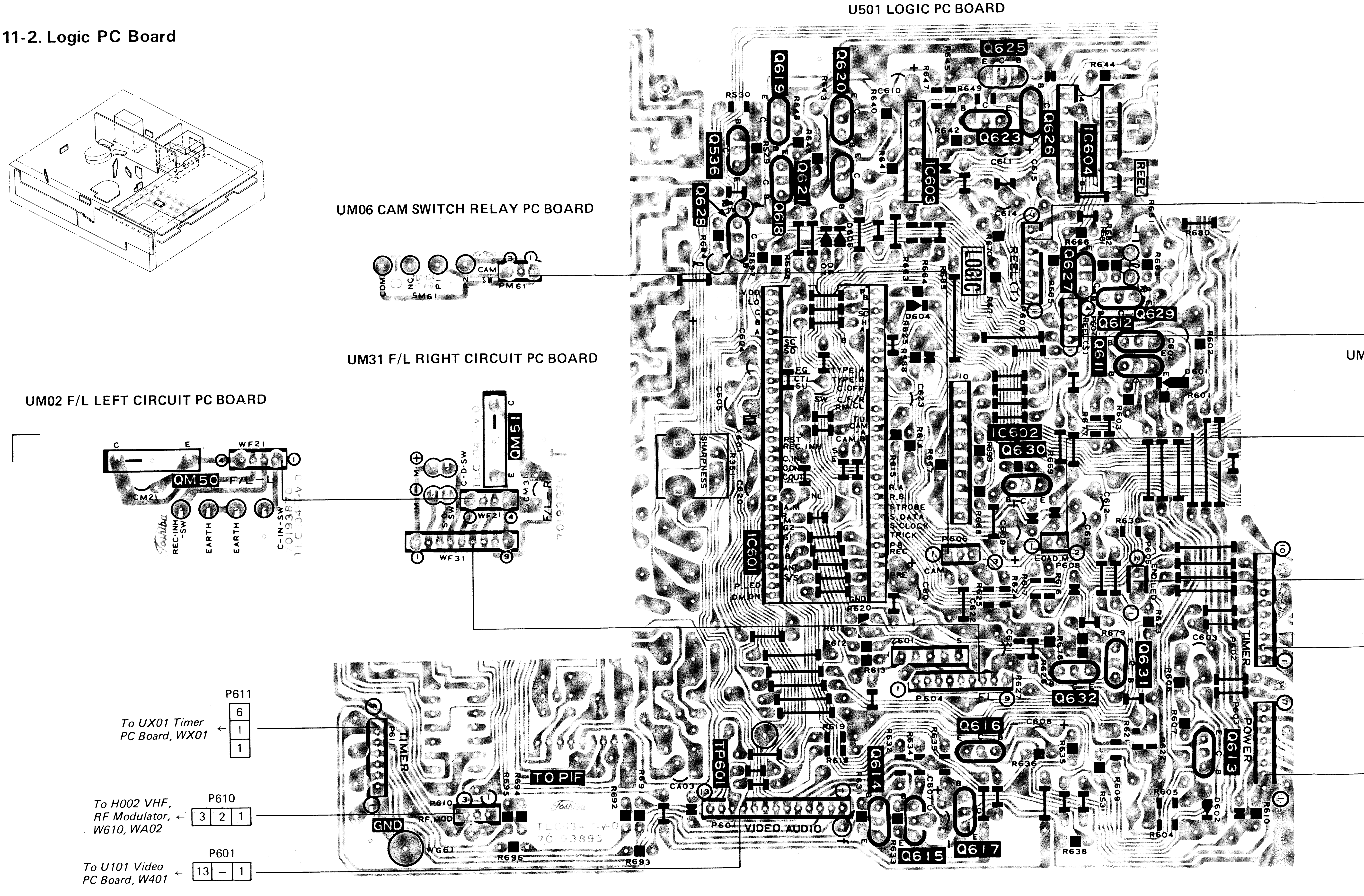
F

G


V: 2V/div.
H: 10ms/div.
V: 10V/div.
H: 10ms/div.
UX01 TIMER
UL01 LOGIC SWITCH
WX03
TRACKING
SLOW TRACKING
V.S. RESET
LOGIC RESET
START CODE
S. DATA
S. CLOCK
GND
TO P602 OF U501 LOGIC CIRCUIT
RS56 100K TRACKING
RS58 500K SLOW TRACKING
VOLTAGE (PLAYBACK MODE)
ICR01 μPC1474HA
REMOTE CONTROL IN
AMP
BAND PASS FILTER
PEAK DET
Vcc
GND
DR01 PH302
GX01 FIP 8QM7
TIMER DISPLAY
WEEKLY SU MO
SP EP
M AM PM
ICX01 TMP47C410AN-6783
TIMER MICR
VDD
SERIAL CLOCK
SERIAL OUTPUT
SERIAL INPUT
START CODE
REMOTE CONTROL
IN 5
AC CLOCK
HOLD
RESET
X OUT
X IN
TEST
IN 4
IN 3
IN 2
IN 1
DISPLAY TUBE GRID
DISPLAY TUBE SEGMENT
LOGIC RESET
POWER LED
XX01 4MHz
RX09 240
DX18 TLR113A-FA POWER
QX04 RN1206
DL05 TLG113A-FA PAUSE/STILL
DL07 TLG113A-FA PLAY
CX06 100μ 6.3V
CX07 .001μ
PX03 A,B
PLAY LED
POWER LED
PAUSE LED
IN 2
IN 3
IN 5
IN 1
IN 4
GND
E+5V
DX17 1SS176
DX16 1SS176
SL06 FF/CUE
SX04 TIMER
SL07 PLAY
SL03 STOP
SL08 REW/REVIEW
SL04 SLOW
SL09 EJECT
SL05 PAUSE/STILL
RX08 10K
RX06 10K
RX05 10K
RX07 10K
TPX03
TPX04
SX19 POWER ON/OFF
SL02 REC
SX02 CH.DOWN
SL01 TV/VTR
SX03 (OTR)
SX10 MIN(−)
SX08 CLEAR
SX01 CH.UP
SX16 MEMORY
SX09 MIN(+)
SX07 CHECK
SX17 RESET
SX11 HOUR
SX13 PROG.NO
SX18 TIMER /COUNTER
SX06 EP/SP
SX12 DAY
SX15 CLK SET
WX01
RMT GND
PLAY LED
PAUSE LED
REC LED
TV/VCR LED
TV/LINE
TO P611 OF U501 LOGIC CIRCUIT
DL01 TLR113 TV/VTR
DL02 TLR113 REC
DX07 1SS176
DX04 1SS176
DX02 1SS176
DX09 1SS176 (16P)
DX14 1SS176
DX12 1SS176
DX13 1SS176
MODE SX14
END START CLK
DX10 1SS176 (12H)
DX03 1SS176
DX15 1SS176
DX11 1SS176
SX05 LINE TV
INPUT CONVERSION SW
V: 10V/div.
H: 5ms/div.

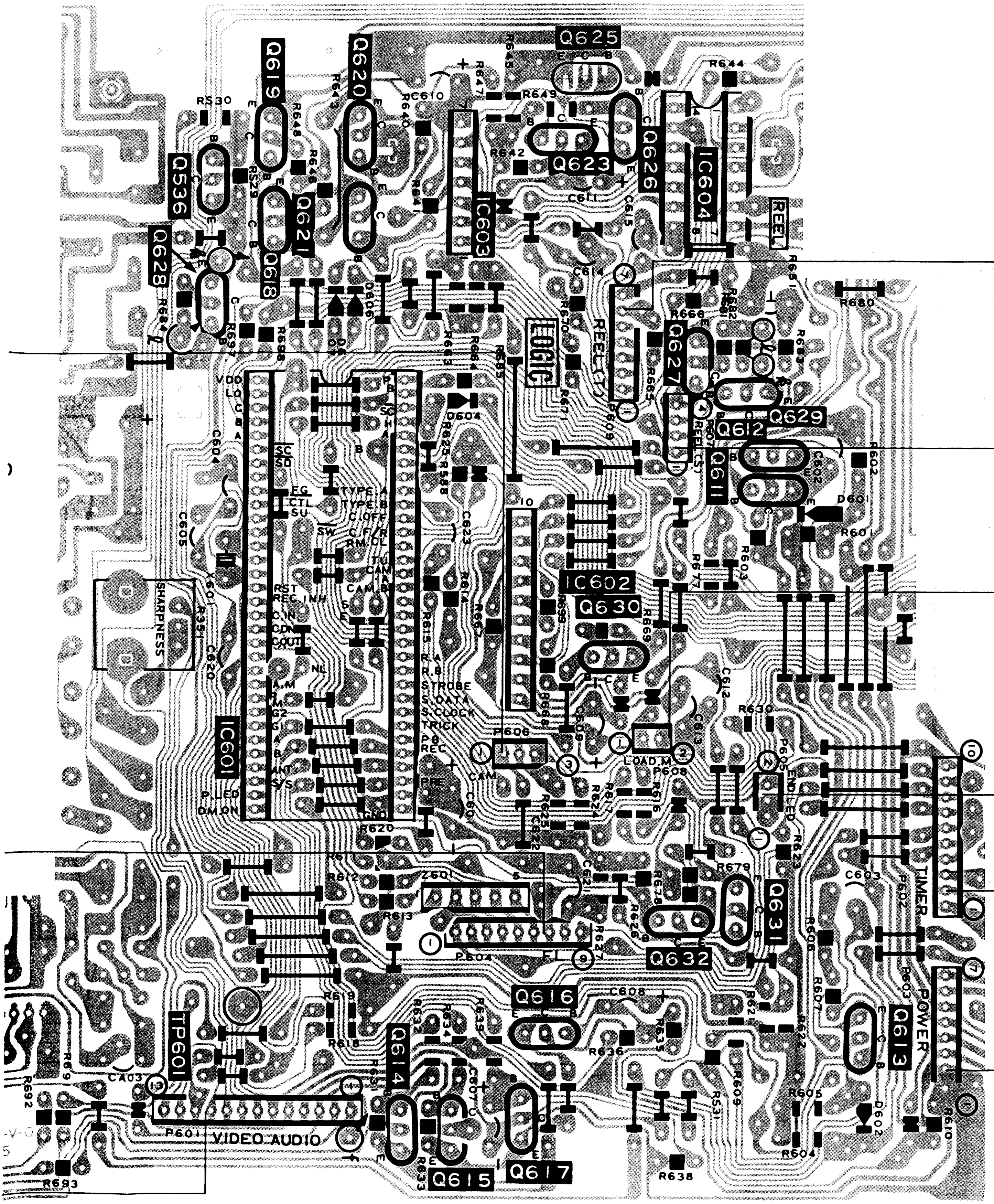

V: 2V/div.
H: 10ms/div.
V: 10V/div.
H: 10ms/div.
UX01 TIMER
GX01
FIP 8QM7
TIMER DISPLAY
WEEKLY SU MO TU WE TH FR SA
TIMER
CATV
SP M
EP AM PM
ON OFF
1 2 3 4
WX03
TRACKING
SLOW TRACKING
V.S RESET
LOGIC RESET
START CODE
S. DATA
S. CLOCK
GND
TO P602 OF U501 LOGIC CIRCUIT
R556 100K TRACKING
R558 500K SLOW TRACKING
ICR01
µPC1474HA
REMOTE CONTROL IN
AMP
BAND PASS FILTER
PEAK DET
Vcc
GND
DR01 PH302
CR01 33µ (16V)
RR02 10
CR02 10µ (16V)
CR05 0.068
LR51 9m
LR01 8.2m
CR06 2200P
CR04 2200P
RR03 5.6K
CR07 47µ (10V)
CR03 10µ (16V)
RR01 2.2K
RR04 22K
VOLTAGE (PLAYBACK MODE)
RX09 240
DL05 TLG113A-FA PAUSE/STILL
DL07 TLG113A-FA PLAY
CX06 100µ (6.3)
CX07 .001µ
PX03 A,B
PLAY LED
POWER LED
PAUSE LED
IN 2
IN 3
IN 5
IN 1
IN 4
GND
E+5V
RX08 10K
SL03 STOP
RX06 10K
SL04 SLOW
RX05 10K
SL05 PAUSE/STILL
RX07 10K
SX19 POWER ON/OFF
TPX04
WX01
RMT GND
PLAY LED
PAUSE LED
REC LED
TV/VCR LED
TV/LINE
TO P511 OF U501 LOGIC CIRCUIT
SL02 REC
SX02 CH.DOWN
SL01 TV/VTR
SX03 (OTR)
SX10 MIN(-)
SX08 CLEAR
SX01 CH.UP
SX16 MEMORY
SX09 MIN(+)
SX07 CHECK
SX17 RESET
SX11 HOUR
SX13 PROG.NO
SX18 TIMER/COUNTER
SX06 EP/SP
SX12 DAY
SX15 CLK SET
DL01 TLR113 TV/VTR
DL02 TLR113 REC
DX07 1SS176
DX04 1SS176
DX02 1SS176
DX14 1SS176
DX12 1SS176
DX09 1SS176 (16P)
MODE SX14
DX13 1SS176
END START CLK
DX10 1SS176 (12H)
DX15 1SS176
DX11 1SS176
TPX01 TPX02
DX03 1SS176
INPUT CONVERSION SW
SX05 LINE TV
CX01 100µ (10V)
CX05 0.01
RX10 2.2K
ICX01 TIMER MICROCOMPUTER
TMP47C410AN-6783
VDD
SERIAL CLOCK
SERIAL OUTPUT
SERIAL INPUT
START CODE
REMOTE CONTROL
IN 5
AC CLOCK
HOLD
RESET
X OUT
X IN
TEST
IN 4
IN 3
IN 2
IN 1
DISPLAY TUBE SEGMENT
DISPLAY TUBE GRID
G9 G8 G7 G6 G5 G4 G3 G2 G1
LOGIC RESET
POWER LED
POWER ON
B0 B1 E0 E1
VSS
RX11 22K
RX16 22K
RX04 10K
CX03 47P
XX01 4MHz
CX02 47P
RX15 22K
RX14 22K
RX13 22K
RX12 22K
ZX01 82K X 9
QX03 RN1202 SWITCH
ZX02 82K X 4
ZX03 82K X 4
QX02 2SC2458Y BUFFER
CX04 0.01
DX01 1SS176
RX02 22K
RX19 1K
WX04
GND
5V
POWER ON
5.6V
AC CLOCK
RESET
TO P860 OF U501 POWER 2 CIRCUIT
WX02
CH. DATA 1
CH. DATA 10
CH. CLK
CH. P. DATA
VKK
F
TO PA02 OF U501 CHANNEL SELECTOR CIRCUIT
V: 10V/div.
H: 5ms/div.
V: 10V/div.
H: 5ms/div.
V: 2V/div.
H: 20ms/div.
V: 2V/div.
H: 5ms/div.

11-2. Logic PC Board

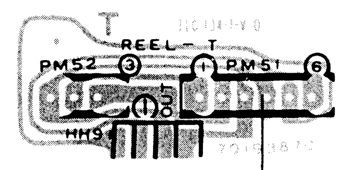

U501 LOGIC PC BOARD
UM06 CAM SWITCH RELAY PC BOARD
UM31 F/L RIGHT CIRCUIT PC BOARD
UM02 F/L LEFT CIRCUIT PC BOARD
P611
6
1
1
To UX01 Timer PC Board, WX01
P610
3 2 1
To H002 VHF, RF Modulator, W610, WA02
P601
13 – 1
To U101 Video PC Board, W401
TO PIF
GND
TIMER
POWER
VIDEO AUDIO
SHARPNESS
LOGIC
REEL
IC601
IC602
IC603
IC604
QM50
QM51
F/L-L
F/L-R
COM
NC
P1
P2
CAM SW
PM61
SM61
WF21
WF31
REC-INH-SW
EARTH
EARTH
C-IN-SW
C-D-SW
UM

6	7	8	9	10	11	12	13	14	15	16

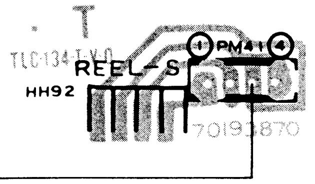
U501 LOGIC PC BOARD


Q625
Q619
Q620
Q623
Q626
IC604
IC603
REEL
Q536
Q621
Q628
Q618
LOGIC
REEL
Q627
Q629
Q612
Q611
D601
D604
IC602
Q630
IC601
SHARPNESS
P606
LOAD.M
P608
P605
END LED
TIMER
P602
Q631
Q632
P604
Q616
C608
Q613
POWER
TP601
P601
VIDEO AUDIO
Q614
Q615
Q617
D602
R651
R680

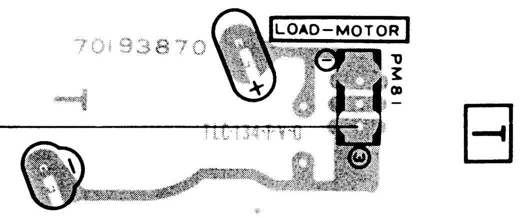
UM05 TAKE-UP REEL SENSOR PC BOARD


REEL-T
PM52
PM51
HH91

UM04 SUPPLY REEL PC BOARD


REEL-S
PM41
HH92
70193870

UM08 LOADING MOTOR RELAY PC BOARD


70193870
LOAD-MOTOR
PM81

P605
2
1
→ *To Tape End DET LED*

P602
10
|
1
→ *To UX01 Timer PC Board, WX03*

P603
7
|
1
→ *To U802 Power 1 PC Board, P805*

Location of Diodes

Symbol No.	Location
D601	C-10
D602	G-10
D604	C-8
D606	B-7
D607	C-7

Location of VR

Symbol No.	Location
R651	B-10

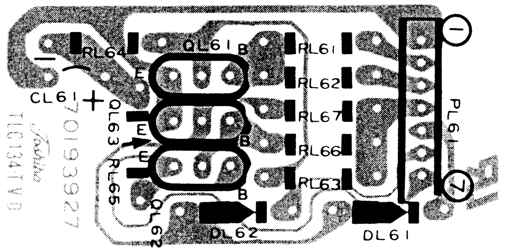
Location of ICs

Symbol No.	Location
IC601	E-7
IC602	D-9
IC603	B-8
IC604	B-9

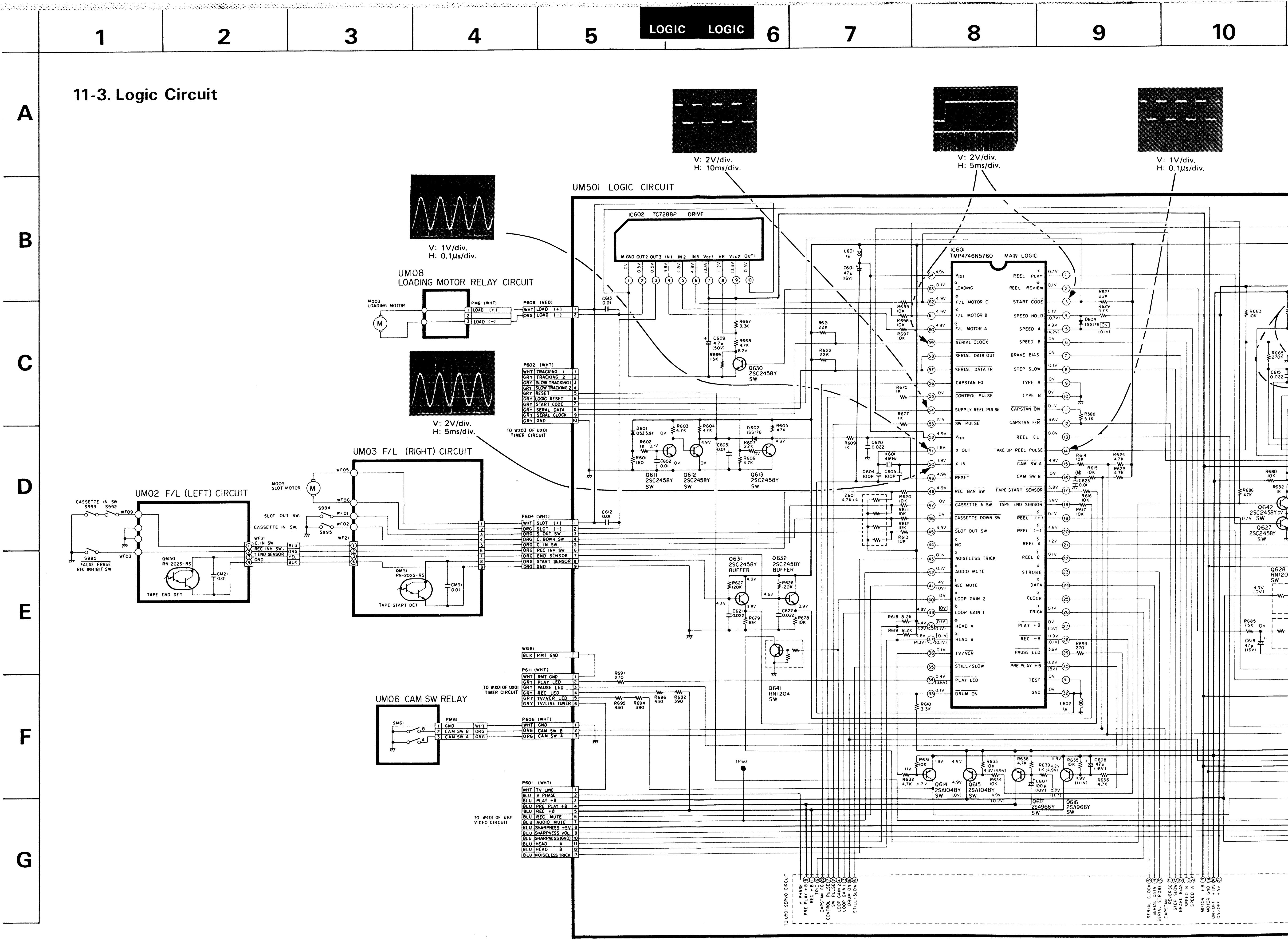
Voltage and Location of Transistors

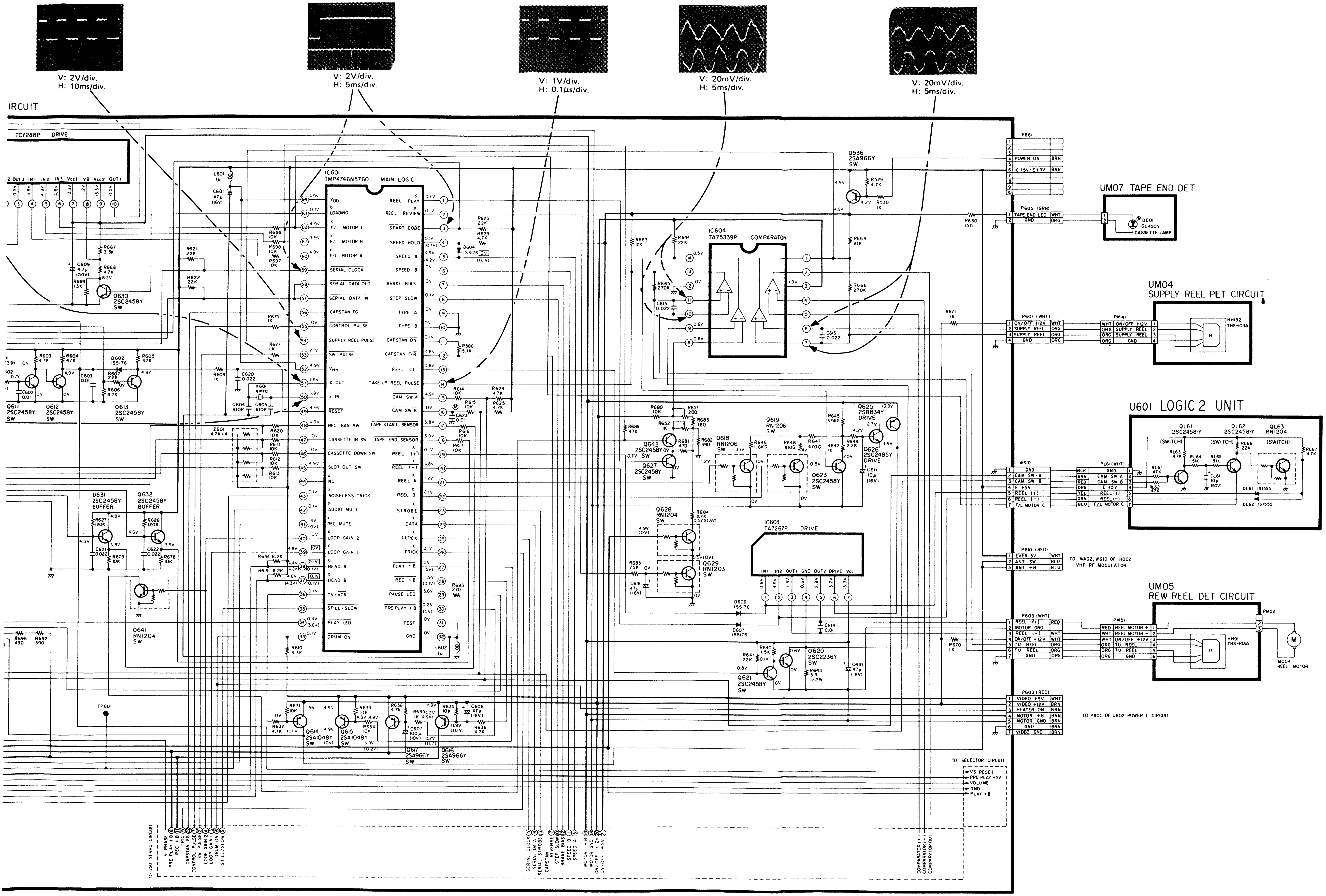
Symbol No.	Voltage (Unit: V)			Location
	E	C	B	
Q611	0	0	0.7	C-9
Q612	0	4.9	0	C-9
Q613	0	4.9	0	F-10
Q614	11.9	11.7	11.0	G-8
Q615	4.9	4.9(0)	4.3(4.9)	G-8
Q616	11.9	0.2 (11.7)	11.9 (11.1)	F-8
Q617	4.9	4.9(0.2)	4.2(4.9)	G-8
Q618	0	3.1	1.2	B-7
Q619	0	4.0	0	A-7
Q620	0	0.6	0.1	A-7
Q621	0	0.1	0.8	B-7
Q623	0	2.5	0.5	B-9
Q625	13.3	3.6	12.7	A-9
Q626	3.6	12.7	4.2	B-9
Q627	0	0	0.7	C-9
Q628	0.5(0)	0.5(0.3)	4.9(0)	B-6
Q629	0	0.5(0)	0	C-10
Q630	0	8.2	0.1	D-9
Q631	3.8	4.9	4.3	F-10
Q632	3.9	5.0	4.6	F-9
Q536	4.9	4.9	4.2	C-7

U601 LOGIC 2 PC BOARD

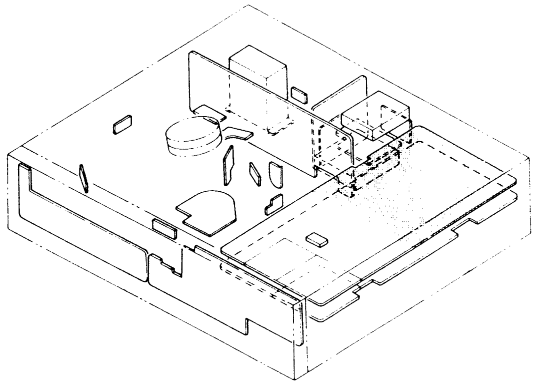

QL61
RL64
RL61
RL62
RL67
RL66
RL63
RL65
QL63
QL62
CL61
PL61
DL62
DL61
70193927

11-3. Logic Circuit

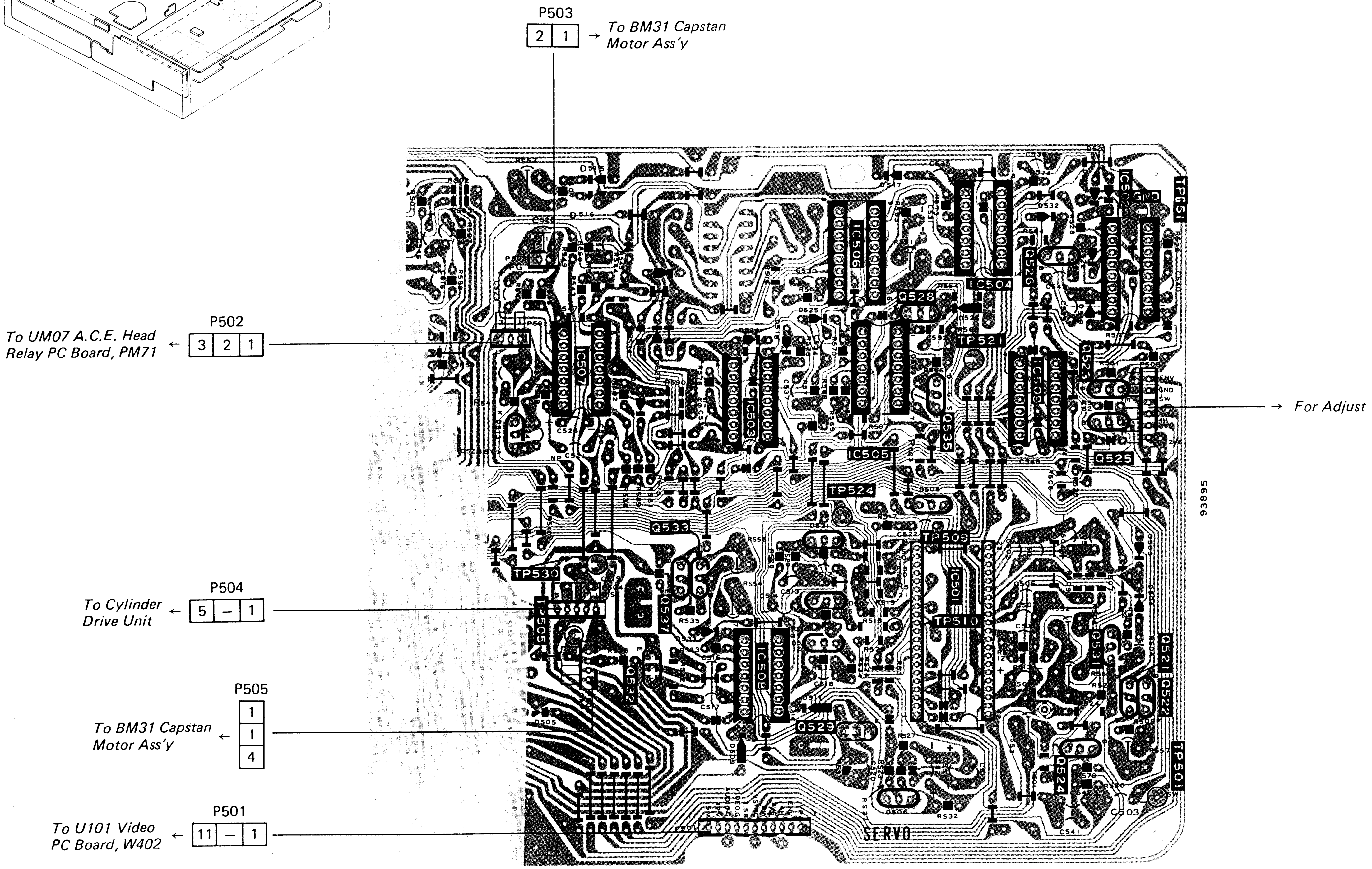

1
2
3
4
5
6
7
8
9
10
A
B
C
D
E
F
G
V: 1V/div.
H: 0.1μs/div.
V: 2V/div.
H: 5ms/div.
V: 2V/div.
H: 10ms/div.
V: 2V/div.
H: 5ms/div.
V: 1V/div.
H: 0.1μs/div.
UM501 LOGIC CIRCUIT
IC602 TC7288P DRIVE
IC601 TMP4746N5760 MAIN LOGIC
UM08 LOADING MOTOR RELAY CIRCUIT
M003 LOADING MOTOR
UM03 F/L (RIGHT) CIRCUIT
UM02 F/L (LEFT) CIRCUIT
M005 SLOT MOTOR
UM06 CAM SW RELAY
QM50 RN-2025-RS
QM51 RN-2025-RS
TAPE END DET
TAPE START DET
S995 FALSE ERASE REC INHIBIT SW
CASSETTE IN SW S993 S992
SLOT OUT SW
CASSETTE IN SW
P608 (RED)
P602 (WHT)
TO WX03 OF UX01 TIMER CIRCUIT
P604 (WHT)
P611 (WHT)
TO WX01 OF UX01 TIMER CIRCUIT
P606 (WHT)
P601 (WHT)
TO W401 OF U101 VIDEO CIRCUIT
Q611 2SC2458Y SW
Q612 2SC2458Y SW
Q613 2SC2458Y SW
Q630 2SC2458Y SW
Q631 2SC2458Y BUFFER
Q632 2SC2458Y BUFFER
Q641 RN1204 SW
Q614 2SA1048Y SW
Q615 2SA1048Y SW
Q617 2SA966Y SW
Q616 2SA966Y SW
Q642 2SC2458Y SW
Q627 2SC2458Y SW
TP601
TO U501 SERVO CIRCUIT


V: 2V/div.
H: 10ms/div.
V: 2V/div.
H: 5ms/div.
V: 1V/div.
H: 0.1μs/div.
V: 20mV/div.
H: 5ms/div.
V: 20mV/div.
H: 5ms/div.
IRCUIT
TC7288P DRIVE
IC601 TMP4746N5760 MAIN LOGIC
IC604 TA75339P COMPARATOR
IC603 TA7267P DRIVE
Q536 2SA966Y SW
Q630 2SC2458Y SW
Q611 2SC2458Y SW
Q612 2SC2458Y SW
Q613 2SC2458Y SW
Q631 2SC2458Y BUFFER
Q632 2SC2458Y BUFFER
Q641 RN1204 SW
Q642 2SC2458Y SW
Q627 2SC2458Y SW
Q618 RN1206 SW
Q619 RN1206 SW
Q623 2SC2458Y SW
Q625 2SB834Y DRIVE
Q626 2SC2485Y DRIVE
Q628 RN1204 SW
Q629 RN1203 SW
Q620 2SC2236Y SW
Q621 2SC2458Y SW
Q614 2SA1048Y SW
Q615 2SA1048Y SW
Q617 2SA966Y SW
Q616 2SA966Y SW
P861
POWER ON
IC +5V/E+5V
P605 (GRN)
TAPE END LED
GND
UM07 TAPE END DET
DE01 GL450V CASSETTE LAMP
UM04 SUPPLY REEL PET CIRCUIT
P607 (WHT)
ON/OFF +12V
SUPPLY REEL
PM41
HH192 THS-103A
U601 LOGIC 2 UNIT
QL61 2SC2458·Y (SWITCH)
QL62 2SC2458·Y (SWITCH)
QL63 RN1204 (SWITCH)
W610
PL61(WHT)
CAM SW-A
CAM SW-B
E +5V
REEL (+)
REEL (−)
F/L MOTOR C
P610 (RED)
EVER 5V
ANT SW
ANT +B
TO WA02, W610 OF H002 VHF RF MODULATOR
UM05 REW REEL DET CIRCUIT
P609 (WHT)
MOTOR GND
TU REEL
PM51
HH91 THS-103A
M004 REEL MOTOR
P603 (RED)
VIDEO +5V
VIDEO +12V
HEATER ON
MOTOR +B
MOTOR ON
MOTOR GND
VIDEO GND
TO P805 OF U802 POWER 1 CIRCUIT
TO SELECTOR CIRCUIT
VS RESET
PRE PLAY +5V
VOLUME
GND
PLAY +B
TP601
TO U501 SERVO CIRCUIT
V PHASE
PRE PLAY +B
REC +B
TRIG
CAPSTAN FG
CONTROL PULSE
SW PULSE
LOOP GAIN 2
LOOP GAIN 1
DRUM ON
STILL/SLOW
SERIAL CLOCK
SERIAL DATA
SERIAL STROBE
CAPSTAN REVERSE
STEP SLOW
BRAKE BIAS
SPEED B
SPEED A
MOTOR +B
MOTOR GND
ON/OFF +12V
ON/OFF +5V
COMPARATOR (−)
COMPARATOR (+)
COMPARATOR OUT

12-2. Servo PC Board



U501 SERVO PC BOARD


P503
2 1
→ To BM31 Capstan Motor Ass'y
P502
To UM07 A.C.E. Head Relay PC Board, PM71 ←
3 2 1
P504
To Cylinder Drive Unit ←
5 – 1
P505
To BM31 Capstan Motor Ass'y ←
1
1
4
P501
To U101 Video PC Board, W402 ←
11 – 1
→ For Adjust
93895
SERVO
IC501
IC502
IC503
IC504
IC505
IC506
IC507
IC508
IC509
Q521
Q522
Q523
Q524
Q525
Q526
Q528
Q529
Q531
Q532
Q533
Q535
Q537
TP501
TP509
TP510
TP521
TP524
TP530
TP651
GND
ENV
SW
1 2 3 4 5 6 7 8 9 10 11
A B C D E F G

Location of Diodes

Symbol No.	Location
D503	E-8
D504	E-8
D505	F-4
D506	G-6
D507	E-6
D508	E-6
D509	F-5
D511	F-6
D512	F-6
D514	D-5
D515	C-4
D516	C-4
D517	C-6
D518	D-6
D519	D-7
D520	C-7
D521	C-7
D522	C-7
D523	D-5
D524	D-5
D526	D-7
D531	E-6
D532	C-7
D533	F-5
D534	C-5

Location of VRs

Symbol No.	Location
R551	F-7
R552	F-7
R553	F-7
R557	F-8
RS51	C-6
RS53	C-4
RS54	E-5
RS55	E-5

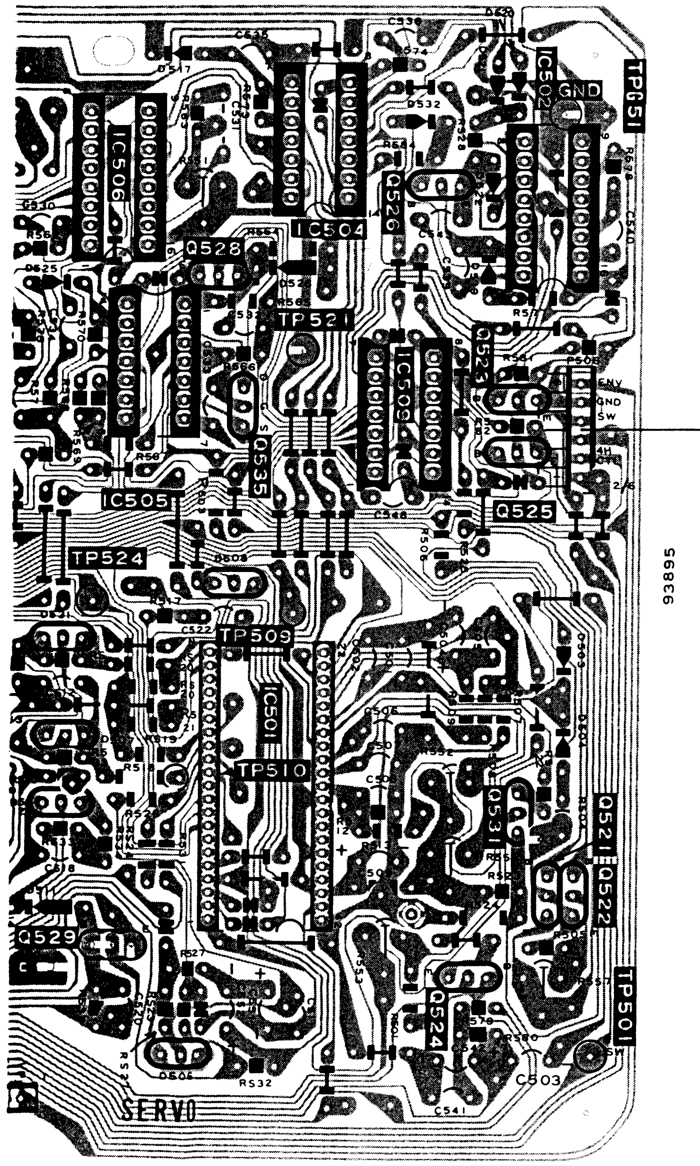
Location of ICs

Symbol No.	Location
IC501	E-7
IC502	C-8
IC503	D-5
IC504	D-7
IC505	E-6
IC506	C-6
IC507	D-4
IC508	F-5
IC509	D-7

Voltage and Location of Transistors

Symbol No.	Voltage (Unit: V)			Location
	E	C	B	
Q521	4.8(4.9)	4.8(1.7)	0.04(4.8)	F-8
Q522	–	–	4.77(4.85)	F-8
Q523	0	2.0	2.4	D-7
Q524	4.9	1.2(4.9)	11.6(0.2)	F-7
Q525	4.9(4.2)	0.2(4.9)	0.03(4.8)	E-8
Q526	0.5	4.8	4.4	C-7
Q528	2.9(3.5)	3.5(4.2)	–	D-6
Q529	2.1(2.6)	13.2 (13.2)	3.3(2.8)	F-6
Q531	2.4(1.4)	2.4	0.1	F-7
Q532	4.4	13.2	5.6	F-5
Q533	3.3(2.7)	3.3(2.7)	3.0(2.1)	E-5
	S	D	G	
Q535	4.8(4.8)	3.9(2.4)	3.2(1.4)	D-7
Q537	0	3.0(0)	0.2(4.2)	E-5

501 SERVO PC BOARD



→ *For Adjust*

Location of Diodes

Symbol No.	Location
D503	E-8
D504	E-8
D505	F-4
D506	G-6
D507	E-6
D508	E-6
D509	F-5
D511	F-6
D512	F-6
D514	D-5
D515	C-4
D516	C-4
D517	C-6
D518	D-6
D519	D-7
D520	C-7
D521	C-7
D522	C-7
D523	D-5
D524	D-5
D526	D-7
D531	E-6
D532	C-7
D533	F-5
D534	C-5

Location of VRs

Symbol No.	Location
R551	F-7
R552	F-7
R553	F-7
R557	F-8
RS51	C-6
RS53	C-4
RS54	E-5
RS55	E-5

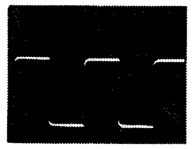
Location of ICs

Symbol No.	Location
IC501	E-7
IC502	C-8
IC503	D-5
IC504	D-7
IC505	E-6
IC506	C-6
IC507	D-4
IC508	F-5
IC509	D-7

Voltage and Location of Transistors

Symbol No.	Voltage (Unit: V)			Location
	E	C	B	
Q521	4.8(4.9)	4.8(1.7)	0.04(4.8)	F-8
Q522	–	–	4.77(4.85)	F-8
Q523	0	2.0	2.4	D-7
Q524	4.9	1.2(4.9)	11.6(0.2)	F-7
Q525	4.9(4.2)	0.2(4.9)	0.03(4.8)	E-8
Q526	0.5	4.8	4.4	C-7
Q528	2.9(3.5)	3.5(4.2)	–	D-6
Q529	2.1(2.6)	13.2 (13.2)	3.3(2.8)	F-6
Q531	2.4(1.4)	2.4	0.1	F-7
Q532	4.4	13.2	5.6	F-5
Q533	3.3(2.7)	3.3(2.7)	3.0(2.1)	E-5
	S	D	G	
Q535	4.8(4.8)	3.9(2.4)	3.2(1.4)	D-7
Q537	0	3.0(0)	0.2(4.2)	E-5

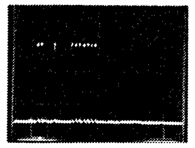
① IC501 Pin ⑤ D-8



Play (EP)

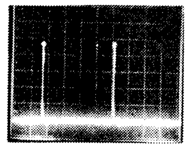
V: 1V/div.
H: 1ms/div.

② IC501 Pin ⑧ E-8



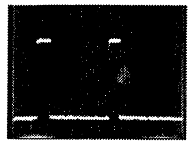
V: 1V/div.
H: 0.2ms/div.

③ IC501 Pin ⑨ E-8



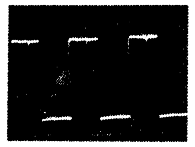
V: 1V/div.
H: 1ms/div.

④ IC501 Pin ⑩ E-8



V: 1V/div.
H: 1ms/div.

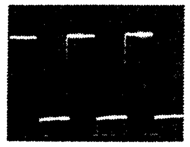
⑤ IC501 Pin ⑬ E-8



Rec, Play, Cue/Review

V: 1V/div.
H: 5μs/div.

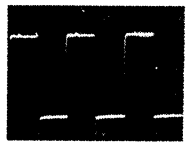
⑥ IC501 Pin ⑭ E-8



Rec, Play, Cue/Review

V: 1V/div.
H: 5μs/div.

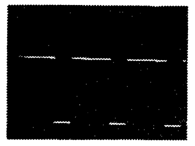
⑦ IC501 Pin ⑮ E-8



Rec, Play, Cue/Review

V: 1V/div.
H: 5μs/div.

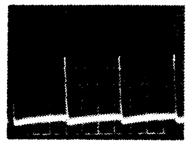
⑧ IC501 Pin ㉓ F-7



Rec

V: 1V/div.
H: 10ms/div.

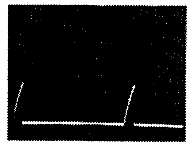
⑨ IC501 Pin ㉕ F-7



Rec

V: 0.2V/div
H: 5ms/div

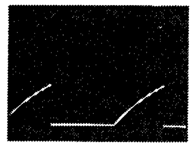
⑩ IC501 Pin ㉗ F-7



Rec, Play (SP)

V: 1V/div.
H: 5ms/div.

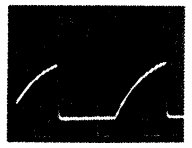
⑪ IC501 Pin ㉗ F-7



Rec, Play (EP)

V: 1V/div.
H: 5ms/div.

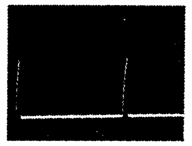
⑫ IC501 Pin ㉘ E-7



Play

V: 1V/div.
H: 5ms/div.

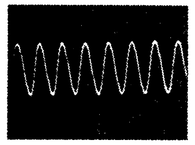
⑬ IC501 Pin ㉚ E-7



Rec, Play, Cue/Review, Slow

V: 1V/div.
H: 5ms/div.

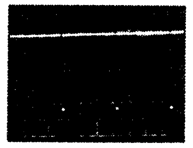
⑭ IC501 Pin ㊶ D-7



Rec, Play, Cue/Review, Slow

V: 200mV/div.
H: 0.2μs/div.

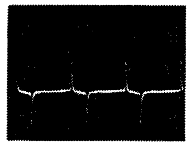
⑮ IC502 Pin ⑨ C-6



Still/Slow, Cue/Review

V: 1V/div.
H: 5ms/div.

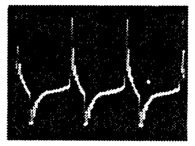
⑯ IC507 Pin ① D-12



Play

V: 1V/div.
H: 10ms/div.

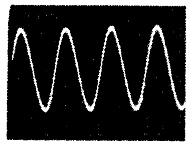
⑰ IC507 Pin ① D-12



Cue/Review

V: 1V/div.
H: 2ms/div.

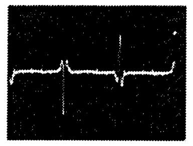
⑱ IC507 Pin ⑦ E-12



Rec, Play, Cue/Review, Slow

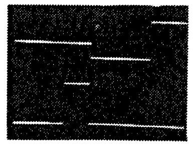
V: 2V/div.
H: 0.5ms/div.

⑲ P504 Pin ③ F-14



V: 500mV/div.
H: 5ms/div.

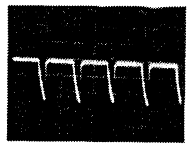
⑳ P506 Pin ⑥ B-3



Slow

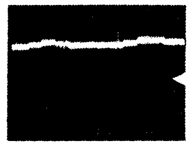
V: 5V/div.
H: 10ms/div.

㉑ Q528 Emitter B-13



V: 1V/div.
H: 1ms/div.

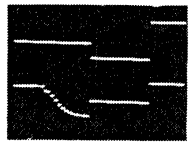
㉒ Q529 Emitter E-13



Rec, Play, Cue/Review

V: 1V/div.
H: 0.5ms/div.

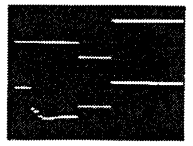
㉓ Q529 Emitter E-13



Slow (SP)

V: 5V/div.
H: 10ms/div.

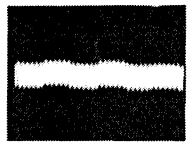
㉔ Q529 Emitter E-13



Slow (EP)

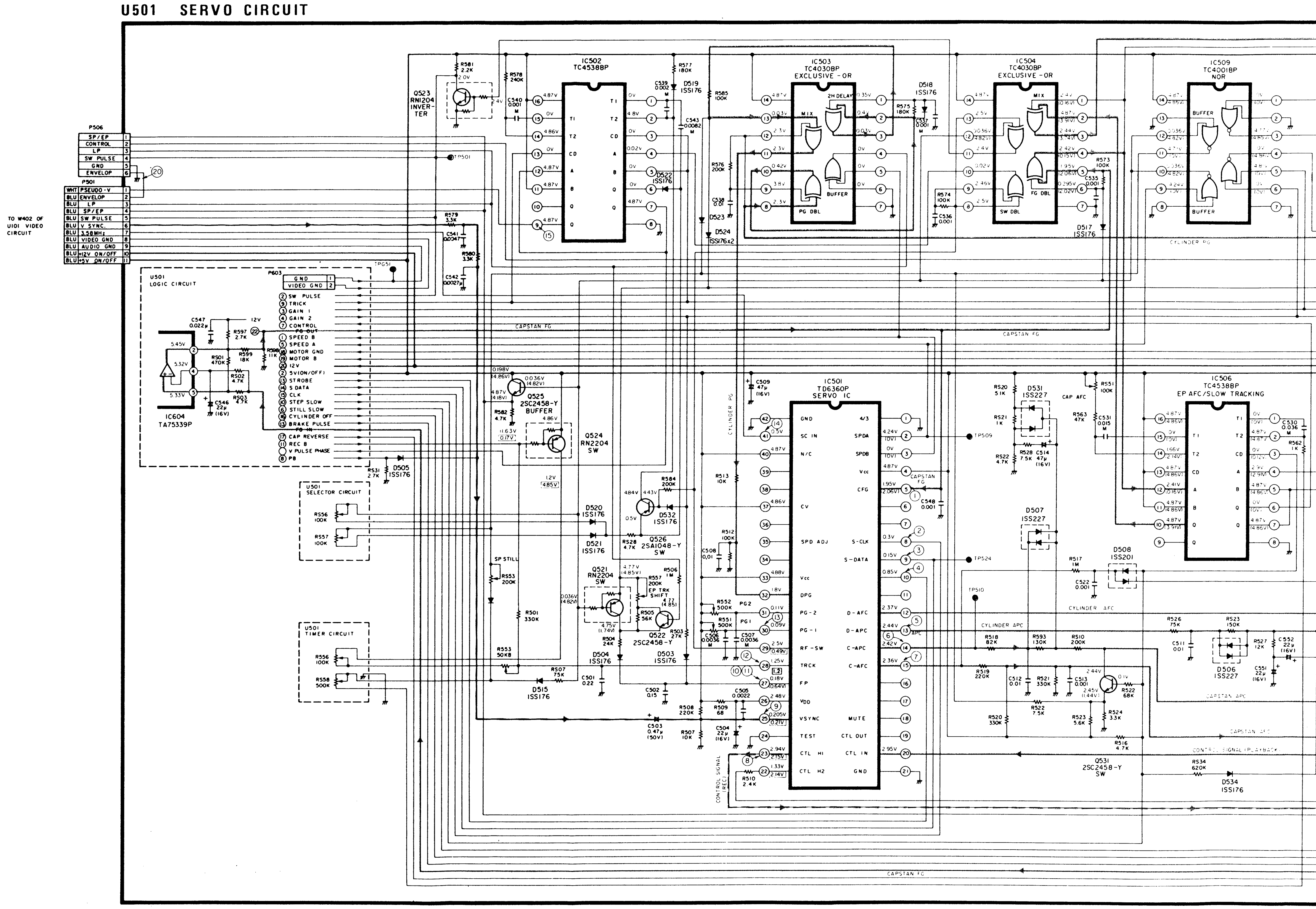
V: 5V/div.
H: 10ms/div.

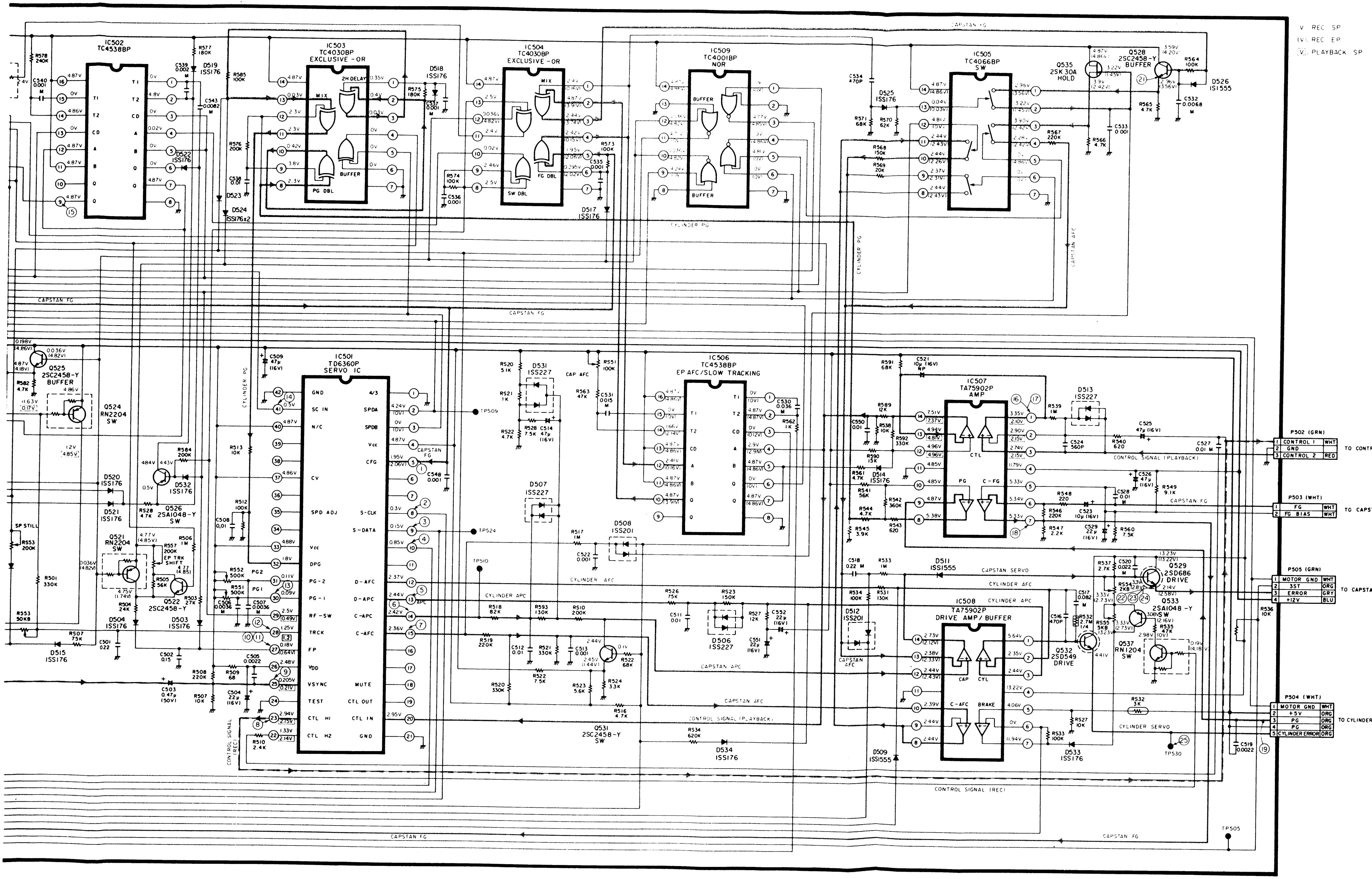
㉕ TP530 F-13



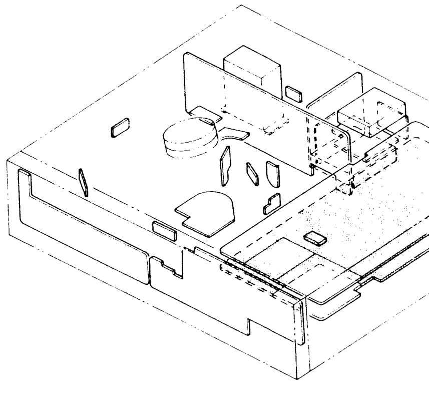
V: 200mV/div.
H: 10ms/div.

12-3. Servo Circuit


U501 SERVO CIRCUIT
P506
SP/EP
CONTROL
LP
SW PULSE
GND
ENVELOP
P501
PSEUDO-V
ENVELOP
LP
SP/EP
SW PULSE
V. SYNC.
3.58MHz
VIDEO GND
AUDIO GND
12V ON/OFF
5V ON/OFF
TO W402 OF U101 VIDEO CIRCUIT
Q523 RN1204 INVERTER
IC502 TC4538BP
IC503 TC4030BP EXCLUSIVE-OR
IC504 TC4030BP EXCLUSIVE-OR
IC509 TC4001BP NOR
U501 LOGIC CIRCUIT
P603
GND
VIDEO GND
SW PULSE
TRICK
GAIN 1
GAIN 2
CONTROL
SPEED B
SPEED A
MOTOR GND
MOTOR B
12V
5V(ON/OFF)
STROBE
S DATA
CLK
STEP SLOW
STILL SLOW
CYLINDER OFF
BRAKE PULSE
CAP REVERSE
REC B
V PULSE PHASE
PB
IC604 TA75339P
Q525 2SC2458-Y BUFFER
Q524 RN2204 SW
U501 SELECTOR CIRCUIT
U501 TIMER CIRCUIT
Q526 2SA1048-Y SW
Q521 RN2204 SW
Q522 2SC2458-Y
EP TRK SHIFT
SP STILL
IC501 TD6360P SERVO IC
CAPSTAN FG
CYLINDER PG
CYLINDER FG
CONTROL SIGNAL (REC)
IC506 TC4538BP EP AFC/SLOW TRACKING
CYLINDER AFC
CYLINDER APC
CAPSTAN APC
CAPSTAN AFC
CONTROL SIGNAL (PLAYBACK)
Q531 2SC2458-Y SW
D534 1SS176
D506 1SS227
D507 1SS227
D508 1SS201
D531 1SS227
TP501
TP509
TP510
TP524
TPG51


V REC SP
(V) REC EP
[V] PLAYBACK SP
IC502 TC4538BP
IC503 TC4030BP EXCLUSIVE-OR
IC504 TC4030BP EXCLUSIVE-OR
IC509 TC4001BP NOR
IC505 TC4066BP SW
Q535 2SK30A HOLD
Q528 2SC2458-Y BUFFER
D526 1SS155
IC501 TD6360P SERVO IC
IC506 TC4538BP EP AFC/SLOW TRACKING
IC507 TA75902P AMP
IC508 TA75902P DRIVE AMP/BUFFER
Q525 2SC2458-Y BUFFER
Q524 RN2204 SW
Q526 2SA1048-Y SW
Q521 RN2204 SW
Q522 2SC2458-Y
Q531 2SC2458-Y SW
Q529 2SD686 DRIVE
Q533 2SA1048-Y
Q532 2SD549 DRIVE
Q537 RN1204 SW
CAPSTAN FG
CYLINDER PG
CAPSTAN AFC
CYLINDER AFC
CAPSTAN SERVO
CYLINDER SERVO
CONTROL SIGNAL (PLAYBACK)
CONTROL SIGNAL (REC)
P502 (GRN) 1 CONTROL 1 WHT 2 GND 3 CONTROL 2 RED TO CONTROL HEAD
P503 (WHT) 1 FG WHT 2 FG BIAS WHT TO CAPSTAN FG
P505 (GRN) 1 MOTOR GND WHT 2 3ST ORG 3 ERROR GRY 4 +12V BLU TO CAPSTAN MOTOR
P504 (WHT) 1 MOTOR GND WHT 2 +5V ORG 3 PG ORG 4 PG ORG 5 CYLINDER ERROR ORG TO CYLINDER MOTOR
TP505
TP509
TP510
TP524
TP530

13-2. Video PC Board



Location of Diodes

Symbol No.	Location
D101	F-4
D102	F-4
D103	F-5
D104	F-4
D105	F-3
D107	F-1
D201	D-5
D202	E-7
D203	D-5
D204	E-9
D205	F-9
D206	D-5

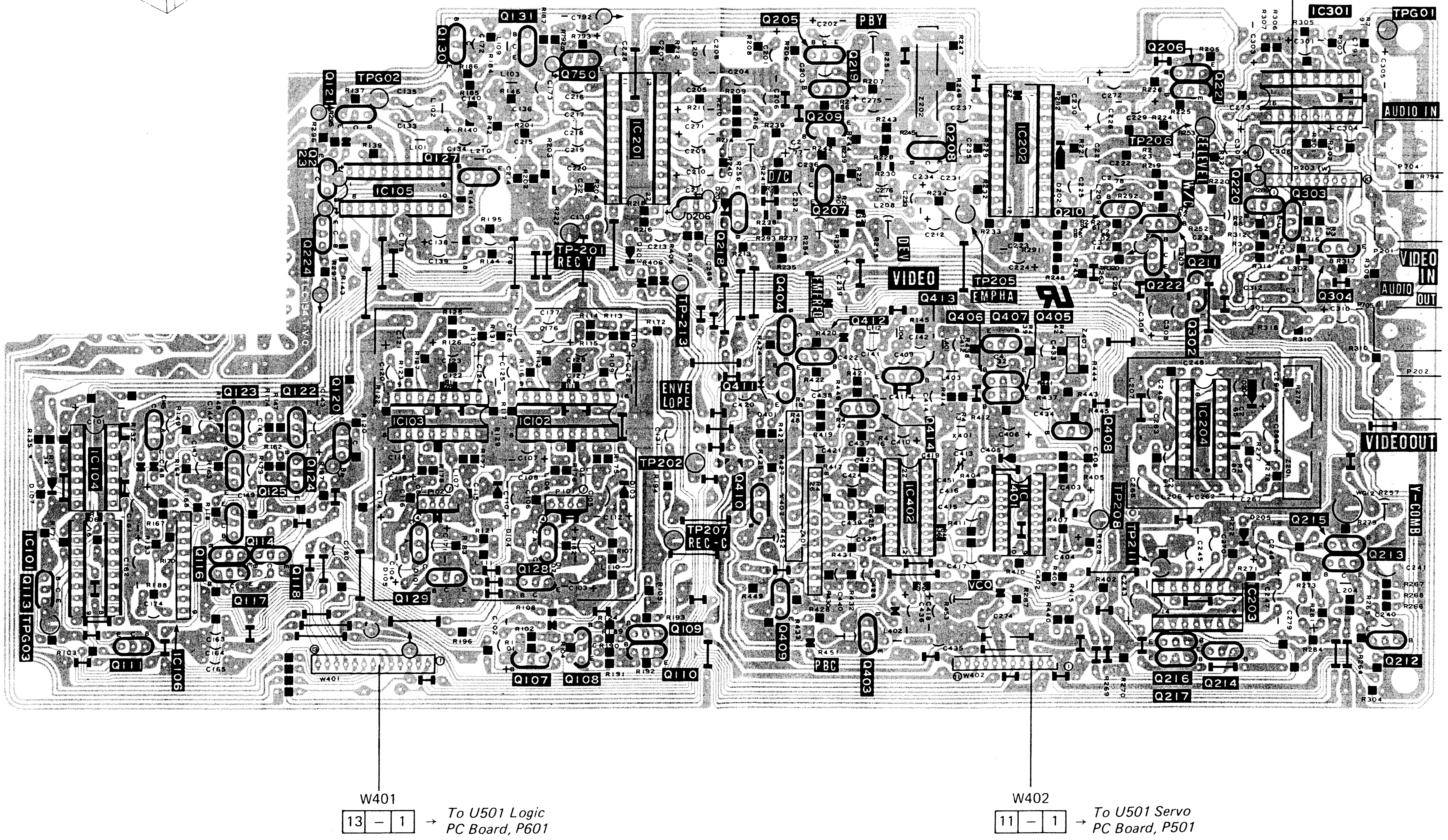
Location of VRs

Symbol No.	Location
R251	C-6
R252	D-8
R254	D-6
R255	D-6
R256	C-6
R257	F-10
R451	G-6
R452	F-6
R453	F-7
C451	E-7

Location of ICs

Symbol No.	Location
IC101	F-1
IC102	E-4
IC103	E-3
IC104	E-1
IC105	D-3
IC201	C-5
IC202	C-7
IC203	F-8
IC204	E-8
IC301	C-8
IC401	F-7
IC402	F-7

U101 VIDEO PC BOARD


1
2
3
4
5
6
7
8
9
10
11
A
B
C
D
E
F
G
To H002 VHF, RF Modulator P.C. Board, WA02
1 – 5
1 – 5
To U102 PIF PC Board, P002
P203
1 – 10
IC301
TPG01
Q131
Q130
Q750
Q205
PBY
Q206
Q121
TPG02
Q219
Q209
Q208
IC201
IC202
TP206
AUDIO IN
Q123
IC105
Q127
D/C
Q207
Q210
Q220
Q303
Q224
TP-201 RECY
D206
Q218
DEV
VIDEO
TP205 EMPHA
Q211
Q222
VIDEO IN
AUDIO OUT
Q304
TP-213
Q404
EMPH
Q413
Q406
Q407
Q405
Q302
Q412
ENVE LOPE
Q411
Q123
Q122
Q120
IC103
IC102
IC104
IC204
Q408
VIDEOOUT
TP202
Q125
Q124
Q410
Q414
IC402
IC401
TP208
TP211
Y-COMB
Q215
Q213
TP207 REC-C
IC101
Q113
TPG03
Q116
Q114
Q117
Q118
Q129
Q128
IC203
Q109
Q409
VCO
Q111
IC106
Q107
Q108
Q110
PBC
Q403
Q216
Q214
Q212
Q217
W401
W402
93846

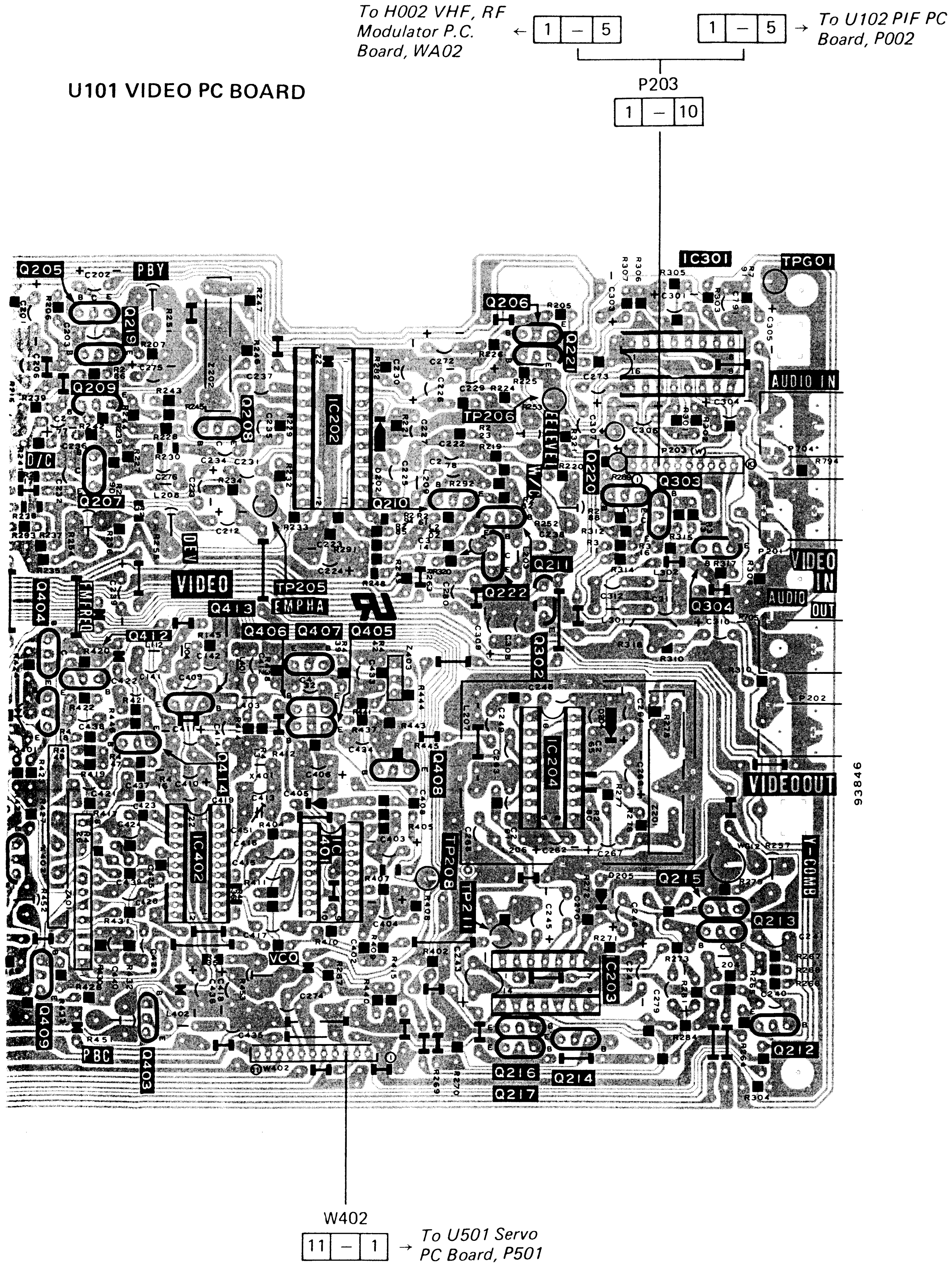
W401
13 – 1 → To U501 Logic PC Board, P601

W402
11 – 1 → To U501 Servo PC Board, P501

Voltage and Locati

Symbol No.	Vol
	E
Q107	6.8(0)
Q108	0
Q109	0
Q110	0
Q111	0
Q113	0
Q114	0
Q116	0.5(4.9)
Q117	0.5(4.9)
Q118	0.5(4.9)
Q120	0.2(4.9)
Q121	0(2.2)
Q122	0(2.6)
Q123	0(2.2)
Q124	0(2.6)
Q125	0(2.2)
Q127	0.2(2.4)
Q128	0
Q129	0
Q130	0(1.5)
Q131	0.2(2.2)
Q205	0.8(0.8)
Q206	0
Q207	1.1(1.1)
Q208	2.0(2.0)
Q209	SP: 1.5 EP: 1.6
Q210	4.5(4.5)
Q211	2.9(2.9)
Q212	1.2(1.2)
Q213	0.5(0.5)
Q214	0.2(4.9)
Q215	0(2.1)
Q216	0
Q217	—
Q218	SP: 0 EP: 2.2
Q219	3.5(3.5)
Q220	12.0 (12.0)
Q221	0
Q222	0
Q223	—
Q224	5.0(5.0)
Q302	0
Q303	1.5(1.5)
Q304	0.9(0.9)
Q403	2.4(2.4)
Q404	5
Q405	2.1(2.1)
Q406	2.0(2.3)
Q407	0(0.8)
Q408	0(2.8)
Q409	—
Q410	4.0(4.0)
Q411	0.7(0)
Q412	0(1.1)
Q413	5
Q414	0(3.9)
Q750	

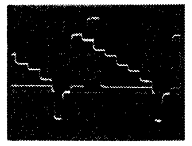
U101 VIDEO PC BOARD

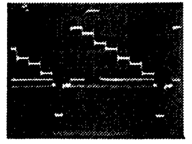

To H002 VHF, RF Modulator P.C. Board, WA02
1 – 5
1 – 5
To U102 PIF PC Board, P002
P203
1 – 10
W402
11 – 1
To U501 Servo PC Board, P501
Q205
PBY
IC301
TPG01
Q206
Q219
Q221
Q209
IC202
Q208
TP206
AUDIO IN
D/C
Q207
Q210
Q220
Q303
DEV
VIDEO
TP205
EMPHA
Q413
Q222
Q211
VIDEO IN
AUDIO OUT
Q304
Q404
Q412
Q406
Q407
Q405
Q302
Q408
IC204
VIDEO OUT
93846
IC402
IC401
TP208
TP211
Q215
Y-COMB
Q213
VCO
IC203
Q409
PBC
Q403
Q216
Q217
Q214
Q212

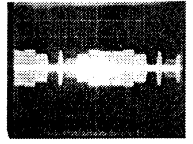
Voltage and Location of Transistors

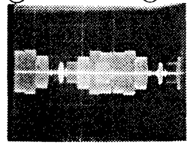
Symbol No.	Voltage (Unit: V)			Location
	E	C	B	
Q107	6.8(0)	12.0(0.2)	0.1(7.7)	G-4
Q108	0	SP: 0 EP: 6.3	SP: 4.3 EP: 0.1	G-4
Q109	0	SP: 6.3 EP: 0	SP: 0 EP: 0.7	F-5
Q110	0	SP: 0 EP: 6.3	SP: 0.7 EP: 0	G-5
Q111	0		7	G-2
Q113	0	2.5(2.5)	2.1(2.1)	F-1
Q114	0	SP: 0 EP: 4.8	SP: 4.3 EP: 0.1	F-3
Q116	0.5(4.9)	SP: 0 EP: 4.8	SP: 4.4 EP: 0.1	F-2
Q117	0.5(4.9)	SP: 0 EP: 4.8	–	F-2
Q118	0.5(4.9)	SP: 4.8 EP: 0	SP: 0 EP: 4.8	F-3
Q120	0.2(4.9)	0.5(4.9)	0.1(0.1)	E-3
Q121	0(2.2)		0.1(2.9)	C-3
Q122	0(2.6)	12	0(3.2)	E-3
Q123	0(2.2)	12	0(2.9)	E-2
Q124	0(2.6)	12	0(3.2)	E-3
Q125	0(2.2)	12	0(2.9)	F-3
Q127	0.2(2.4)	0	0(1.7)	C-4
Q128	0	SP: 6.0 EP: 0	SP: 0.1 EP: 5.7	F-4
Q129	0	SP: 0.1 EP: 5.7	SP: 4.4 EP: 0.1	F-3
Q130	0(1.5)	0(3.5)	0(2.2)	C-4
Q131	0.2(2.2)	0		C-4
Q205	0.8(0.8)	4.2(4.2)	1.5(1.5)	C-6
Q206	0	2.7(0)	0(5.0)	C-8
Q207	1.1(1.1)	0	0.4(0.4)	D-6
Q208	2.0(2.0)	0	1.3(1.3)	C-7
Q209	SP: 1.5 EP: 1.6	SP: 7.5 EP: 0	SP: 0.9 EP: 2.2	C-6
Q210	4.5(4.5)	2.2(2.2)	3.8(3.8)	D-8
Q211	2.9(2.9)	0	2.2(2.2)	D-8
Q212	1.2(1.2)	0	0.5(0.5)	G-10
Q213	0.5(0.5)	0.2(4.9)	1.2(1.2)	F-9
Q214	0.2(4.9)	SP: 4.9 EP: 0	SP: 0.2 EP: 4.3	G-9
Q215	0(2.1)	0	0(1.4)	F-9
Q216	0	12.0(0)	0.2(4.9)	G-8
Q217	–	0(11.9)	12.0(0)	G-8
Q218	SP: 0 EP: 2.2	SP: 5.0 EP: 2.8	SP: 0.2 EP: 2.8	D-5
Q219	3.5(3.5)	5.0	4.2(4.2)	
Q220	12.0 (12.0)	11.9(0)	11.2 (12.0)	D-9
Q221	0	0(12.0)	2.7(0)	C-8
Q222	0	0(0)	5.0(0)	D-8
Q223	–	0(0)	5.0(5.0)	C-3
Q224	5.0(5.0)	–	0.3(0.3)	D-4
Q302	0	2.0(2.0)	1.3(1.3)	
Q303	1.5(1.5)	3.5(3.5)	2.2(2.2)	D-9
Q304	0.9(0.9)	11.6 (11.6)	1.5(1.5)	D-9
Q403	2.4(2.4)	0	1.8(1.8)	G-6
Q404	5	5(0)	0.2(4.9)	D-6
Q405	2.1(2.1)	5	2.8(2.8)	D-7
Q406	2.0(2.3)	5.0	2.7(3.0)	D-7
Q407	0(0.8)	0(3.0)	0(1.5)	D-7
Q408	0(2.8)		0(3.5)	E-8
Q409	–	4.5(4.5)	1.3(1.3)	F-6
Q410	4.0(4.0)	4.7(4.7)	4.5(4.5)	F-6
Q411	0.7(0)	3.8(2.5)	1.4(0)	E-6
Q412	0(1.1)	3.8(2.5)	0(1.8)	D-6
Q413	5	4.9(3.0)	0.2(4.9)	D-7
Q414	0(3.9)	0(1.8)	0(3.2)	E-7
Q750				C-4

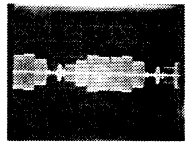
REC Mode

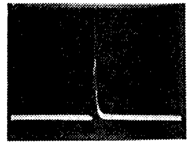
① IC201 Pin ㉒

V: 0.2V/div.
H: 10μs/div. C-6

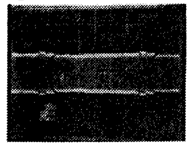
② IC202 Pin ⑱

V: 0.2V/div.
H: 10μs/div. C-5

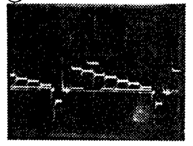
③ IC402 Pin ⑭

V: 0.5V/div.
H: 10μs/div. C-10

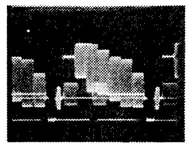
④ IC402 Pin ㉑

V: 0.2V/div.
H: 10μs/div. B-10

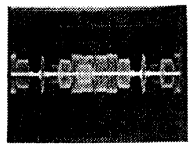
⑤ IC402 Pin ㉒

V: 0.1V/div.
H: 10μs/div. B-10

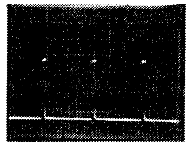
⑥ W402 Pin ⑥

V: 0.5V/div.
H: 1ms/div. C-15

⑦ TP201

V: 0.2V/div.
H: 10μs/div. E-11

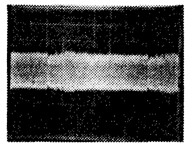
⑧ TP205

V: 0.1V/div.
H: 10μs/div. C-5

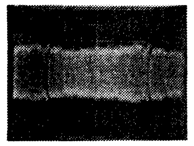
⑨ TP206

V: 0.2V/div.
H: 10μs/div. B-4

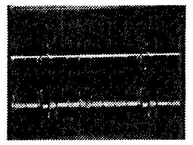
⑩ TP207

V: 50mV/div.
H: 0.1μs/div. E-11

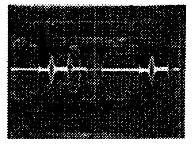
⑪ TP213

V: 1V/div.
H: 20μs/div. B-6

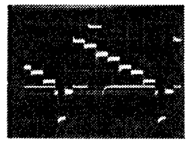
PLAY Mode

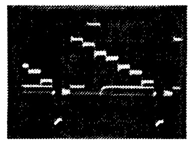
⑫ IC201 Pin ⑤

V: 50mV/div.
H: 10μs/div. B-7

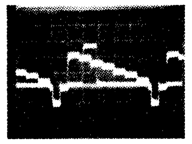
⑬ IC201 Pin ⑥

V: 50mV/div.
H: 10μs/div. B-7

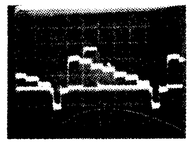
⑭ IC201 Pin ⑮ Pin ⑯

V: 0.2V/div.
H: 10μs/div. C-7

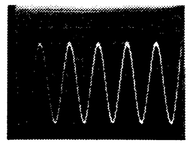
⑮ IC201 Pin ⑰

V: 0.1V/div.
H: 10μs/div. C-7

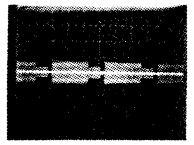
⑯ IC201 Pin ⑱

V: 0.2V/div.
H: 10μs/div. C-7

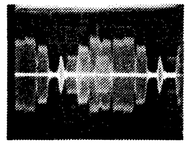
⑰ IC202 Pin ⑱

V: 0.2V/div.
H: 10μs/div. C-5

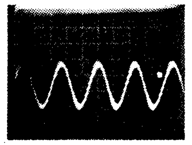
⑱ IC203 Pin ⑥

V: 0.2V/div.
H: 10μs/div. F-5

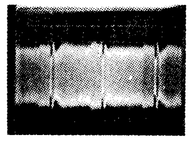
⑲ IC204 Pin ⑪

V: 0.2V/div.
H: 10μs/div. F-3

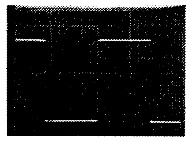
⑳ IC204 Pin ⑮

V: 0.1V/div.
H: 0.05μs/div. F-4

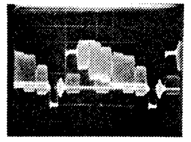
㉑ IC402 Pin ①

V: 0.2V/div.
H: 5ms/div. C-12

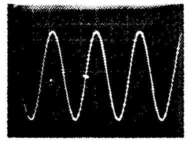
㉒ IC402 Pin ⑭

V: 0.2V/div.
H: 10μs/div. C-10

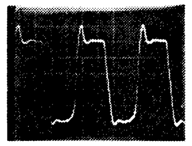
㉓ IC402 Pin ⑱

V: 50mV/div.
H: 0.1μs/div. C-10

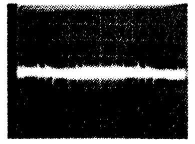
㉔ TP202

V: 0.1V/div.
H: 5ms/div. E-11

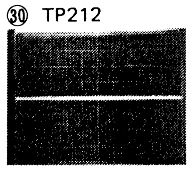
㉕ TP203

V: 1V/div.
H: 5ms/div. D-12

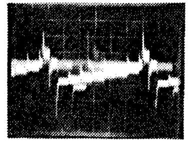
㉖ TP204

V: 0.5V/div.
H: 10μs/div. D-4

㉗ TP208

V: 0.1V/div.
H: 0.1μs/div. B-13

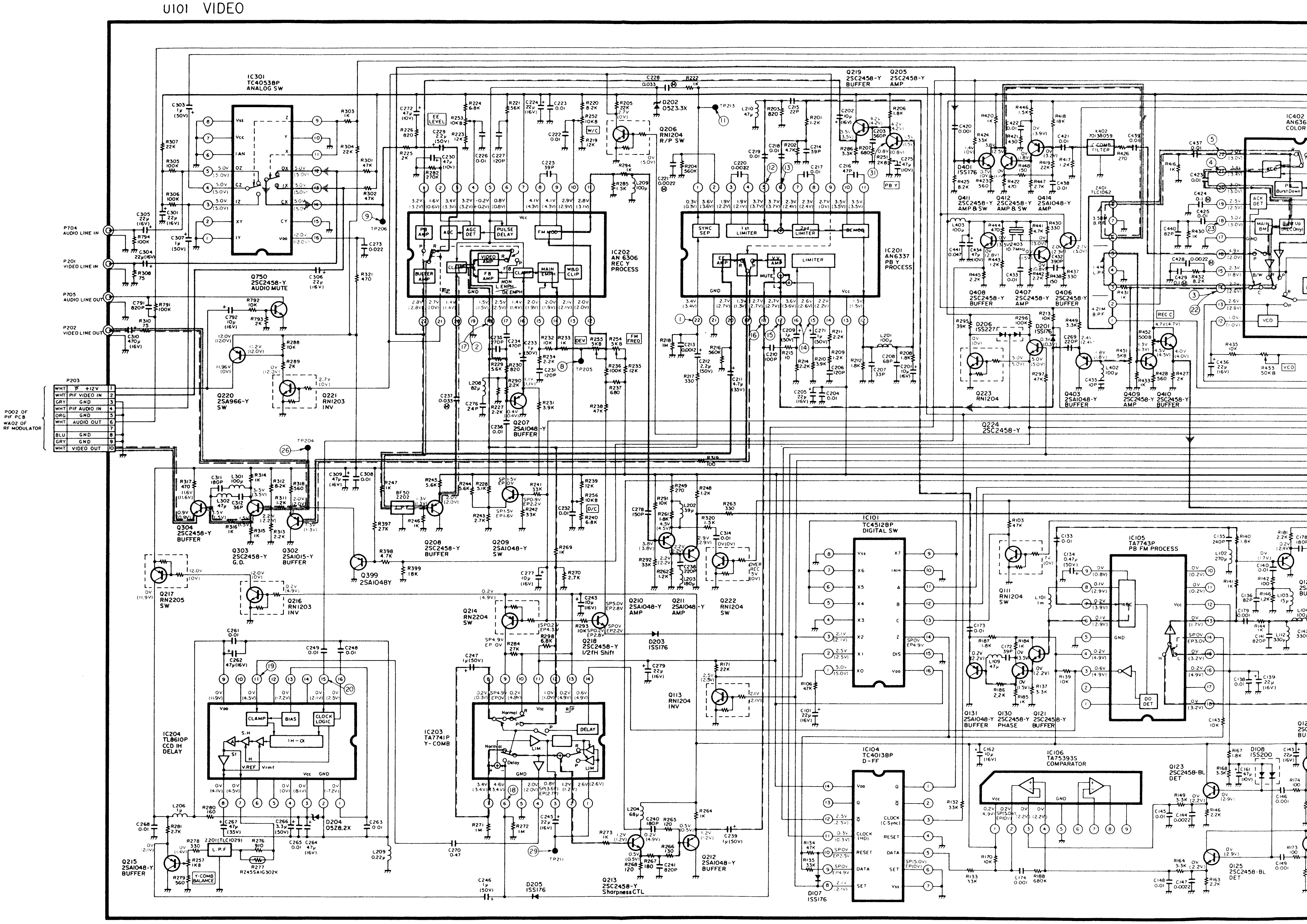
㉘ TP210

V: 0.1V/div.
H: 0.05μs/div. C-12

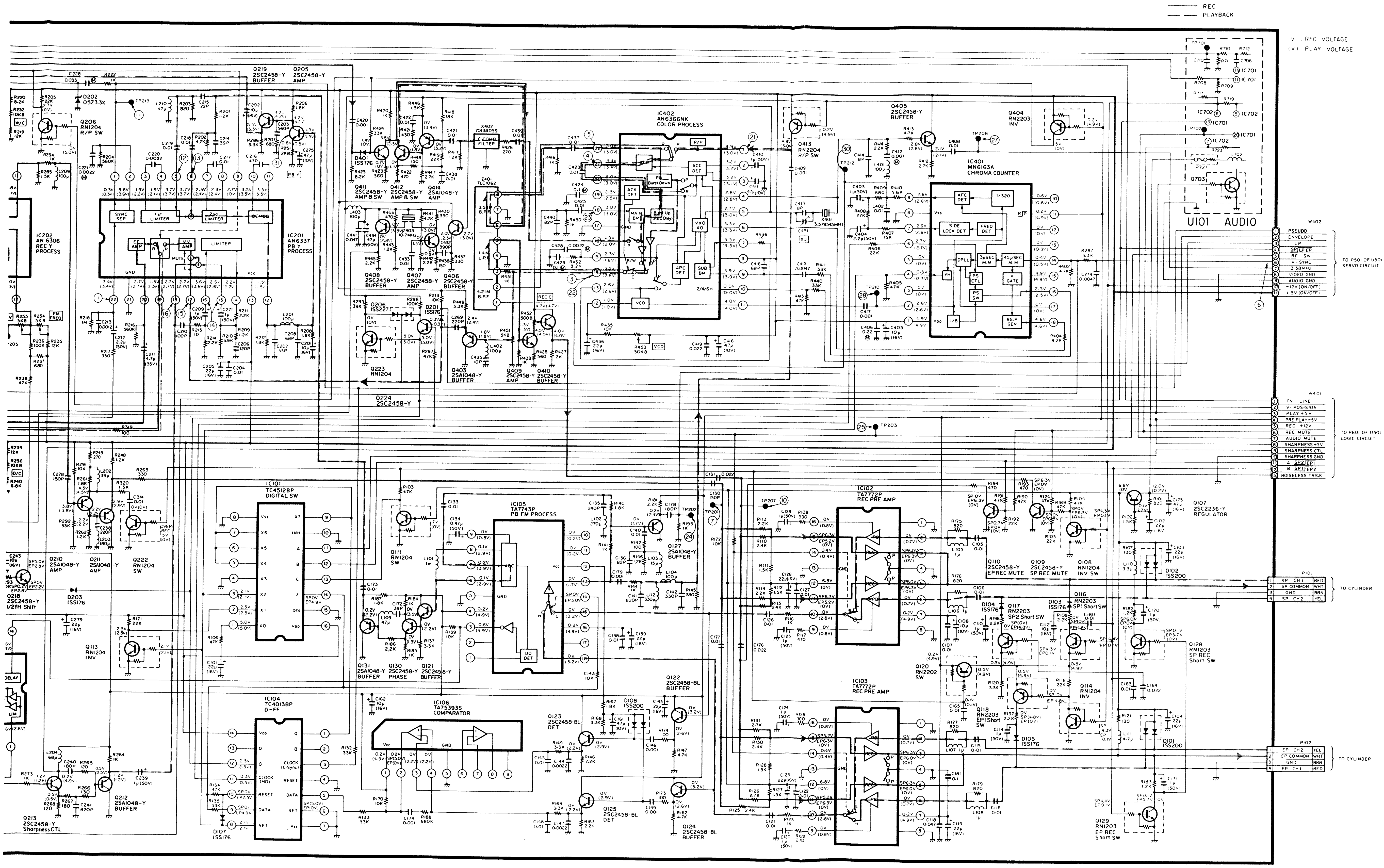
㉙ TP211

V: 0.5V/div.
H: 10μs/div. G-5

㉚ TP212

V: 20mV/div.
H: 5ms/div. B-12

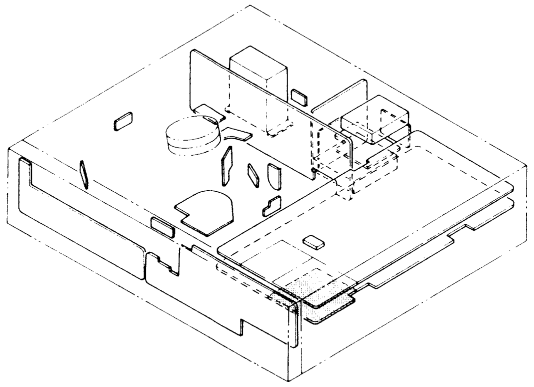
㉛ Q205 Emitter

V: 50mV/div.
H: 10μs/div. B-8

13-3. Video Circuit


U101 VIDEO
IC301 TC4053BP ANALOG SW
P704 AUDIO LINE IN
P201 VIDEO LINE IN
P705 AUDIO LINE OUT
P202 VIDEO LINE OUT
P203
P002 OF PIF PCB
WA02 OF RF MODULATOR
Q750 2SC2458-Y AUDIO MUTE
Q220 2SA966-Y SW
Q221 RN1203 INV
IC202 AN6306 REC Y PROCESS
Q207 2SA1048-Y BUFFER
Q206 RN1204 R/P SW
D202 05Z3.3X
IC201 AN6337 PB Y PROCESS
Q219 2SC2458-Y BUFFER
Q205 2SC2458-Y AMP
Q401 1SS176
Q411 2SC2458-Y AMP B SW
Q412 2SC2458-Y AMP B SW
Q414 2SA1048-Y AMP
X402 701.38059 COMB FILTER
Z401 TLC1062
Q408 2SC2458-Y BUFFER
Q407 2SC2458-Y AMP
Q406 2SC2458-Y BUFFER
D206 1SS227
D201 1SS176
Q223 RN1204
Q224 2SC2458-Y
Q403 2SA1048-Y BUFFER
Q409 2SC2458-Y AMP
Q410 2SC2458-Y BUFFER
IC402 AN636 COLOR
Q304 2SC2458-Y BUFFER
Q303 2SC2458-Y G.D.
Q302 2SA1015-Y BUFFER
Q399 2SA1048Y
Q208 2SC2458-Y BUFFER
Q209 2SA1048-Y SW
Q217 RN2205 SW
Q216 RN1203 INV
Q214 RN2204 SW
Q218 2SC2458-Y 1/2fH Shift
D203 1SS176
Q210 2SA1048-Y AMP
Q211 2SA1048-Y AMP
Q222 RN1204 SW
Q113 RN1204 INV
IC101 TC4512BP DIGITAL SW
Q111 RN1204 SW
IC105 TA7743P PB FM PROCESS
Q131 2SA1048-Y BUFFER
Q130 2SC2458-Y PHASE
Q121 2SC2458-Y BUFFER
IC204 TL8610P CCD 1H DELAY
IC203 TA7741P Y-COMB
IC104 TC4013BP D-FF
IC106 TA75393S COMPARATOR
Q123 2SC2458-BL DET
Q125 2SC2458-BL DET
D108 1SS200
D107 1SS176
Q215 2SA1048-Y BUFFER
Z201 (TLC1029) L.P.F.
Y-COMB BALANCE
D204 05Z8.2X
D205 1SS176
Q213 2SC2458-Y Sharpness CTL
Q212 2SA1048-Y BUFFER
TP204
TP205
TP206
TP211
TP213
1 2 3 4 5 6 7 8 9 10
A B C D E F G


REC
PLAYBACK
V : REC VOLTAGE
(V) PLAY VOLTAGE
IC202 AN6306 REC Y PROCESS
IC201 AN6337 PB Y PROCESS
SYNC SEP
1st LIMITER
2nd LIMITER
LIMITER
MUTE
Q206 RN1204 R/P SW
Q219 2SC2458-Y BUFFER
Q205 2SC2458-Y AMP
D202 05Z3.3X
TP213
Q223 RN1204
Q224 2SC2458-Y
D206 1SS227
D201 1SS176
D401 1SS176
Q411 2SC2458-Y AMP B SW
Q412 2SC2458-Y AMP B SW
Q414 2SA1048-Y AMP
Q408 2SC2458-Y BUFFER
Q407 2SC2458-Y AMP
Q406 2SC2458-Y BUFFER
Q403 2SA1048-Y BUFFER
Q409 2SC2458-Y AMP
Q410 2SC2458-Y BUFFER
X402 7013B059 C.COMB FILTER
Z401 TLC1062
3.58 B.P.F
1.4M L.P.F
4.21M B.P.F
REC C
IC402 AN6366NK COLOR PROCESS
R/P
ACC DLT
ACK DET
MAIN BM
Burst Down
Burst Up (REC Only)
APC DET
SUB BM
VXO XO
VCO
2/4/6H
Q413 RN2204 R/P SW
Q405 2SC2458-Y BUFFER
Q404 RN2203 INV
TP212
TP208
TP210
X401 3.579545MHz
IC401 MN6163A CHROMA COUNTER
AFC DET
1/320
SIDE LOCK DET
FREQ DET
DPLL
3μSEC M.M
45μSEC M.M
FH
PS CTL
PS SW
V GATE
1/8
BG-P GEN
IC702
IC701
Q703
U101 AUDIO
W402
PSEUDO
ENVELOPE
LP
SP/LP EP
RF-SW
V-SYNC
3.58MHz
VIDEO GND
AUDIO GND
+12V (ON/OFF)
+5V (ON/OFF)
TO P501 OF U501 SERVO CIRCUIT
W401
TV-LINE
V-POSISION
PLAY+5V
PRE PLAY+5V
REC +12V
REC MUTE
AUDIO MUTE
SHARPNESS+5V
SHARPNESS CTL
SHARPNESS GND
A SP2/EP1
B SP1/EP2
NOISELESS TRICK
TO P601 OF U501 LOGIC CIRCUIT
TP203
IC101 TC4512BP DIGITAL SW
IC104 TC4013BP D-FF
IC105 TA7743P PB FM PROCESS
IC106 TA75393S COMPARATOR
IC102 TA7772P REC PRE AMP
IC103 TA7772P REC PRE AMP
DO DET
Q210 2SA1048-Y AMP
Q211 2SA1048-Y AMP
Q222 RN1204 SW
Q218 2SC2458-Y 1/2fH Shift
D203 1SS176
Q113 RN1204 INV
Q212 2SA1048-Y BUFFER
Q213 2SC2458-Y Sharpness CTL
D107 1SS176
Q111 RN1204 SW
Q131 2SA1048-Y BUFFER
Q130 2SC2458-Y PHASE
Q121 2SC2458-Y BUFFER
Q127 2SA1048-Y BUFFER
Q122 2SC2458-BL BUFFER
Q123 2SC2458-BL DET
D108 1SS200
Q125 2SC2458-BL DET
Q124 2SC2458-BL BUFFER
TP207
TP202
TP201
Q110 2SC2458-Y EP REC MUTE
Q109 2SC2458-Y SP REC MUTE
Q108 RN1204 INV SW
Q107 2SC2236-Y REGULATOR
D102 1SS200
D104 1SS176
Q117 RN2203 SP2 Short SW
D103 1SS176
Q116 RN2203 SP1 Short SW
Q128 RN1203 SP REC Short SW
Q120 RN2202 SW
Q118 RN2203 EP1 Short SW
Q114 RN1204 INV
D105 1SS176
D101 1SS200
Q129 RN1203 EP REC Short SW
P101
SP CH1 RED
SP COMMON WHT
GND BRN
SP CH2 YEL
TO CYLINDER
P102
EP CH2 YEL
EP COMMON WHT
GND BRN
EP CH1 RED
TO CYLINDER

14-2. Audio PC Board



Location of VRs

Symbol No.	Location
R751	D-5
R752	D-5

Location of ICs

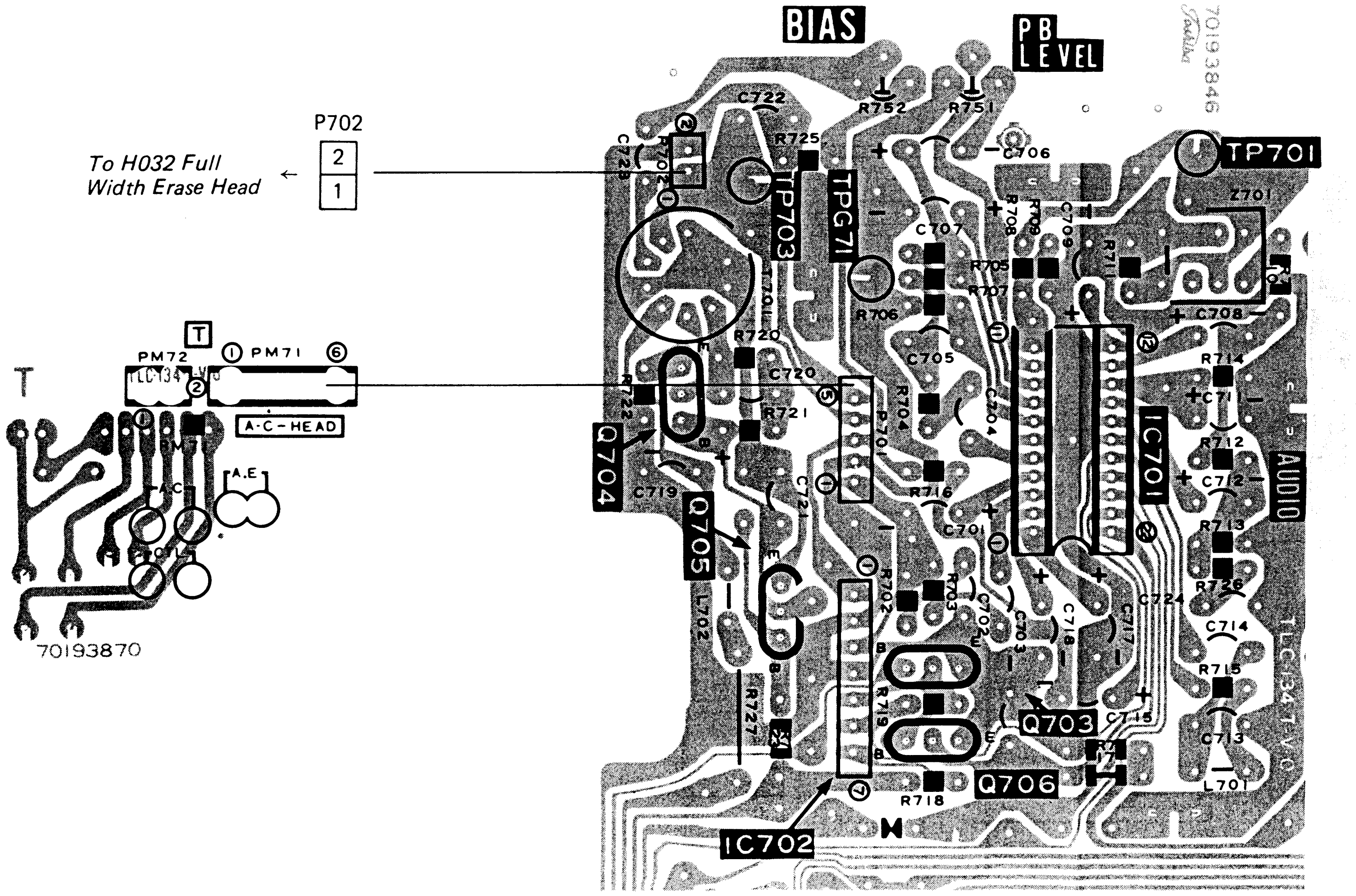
Symbol No.	Location
IC701	E-6
IC702	G-4

Voltage and Location of Transistors

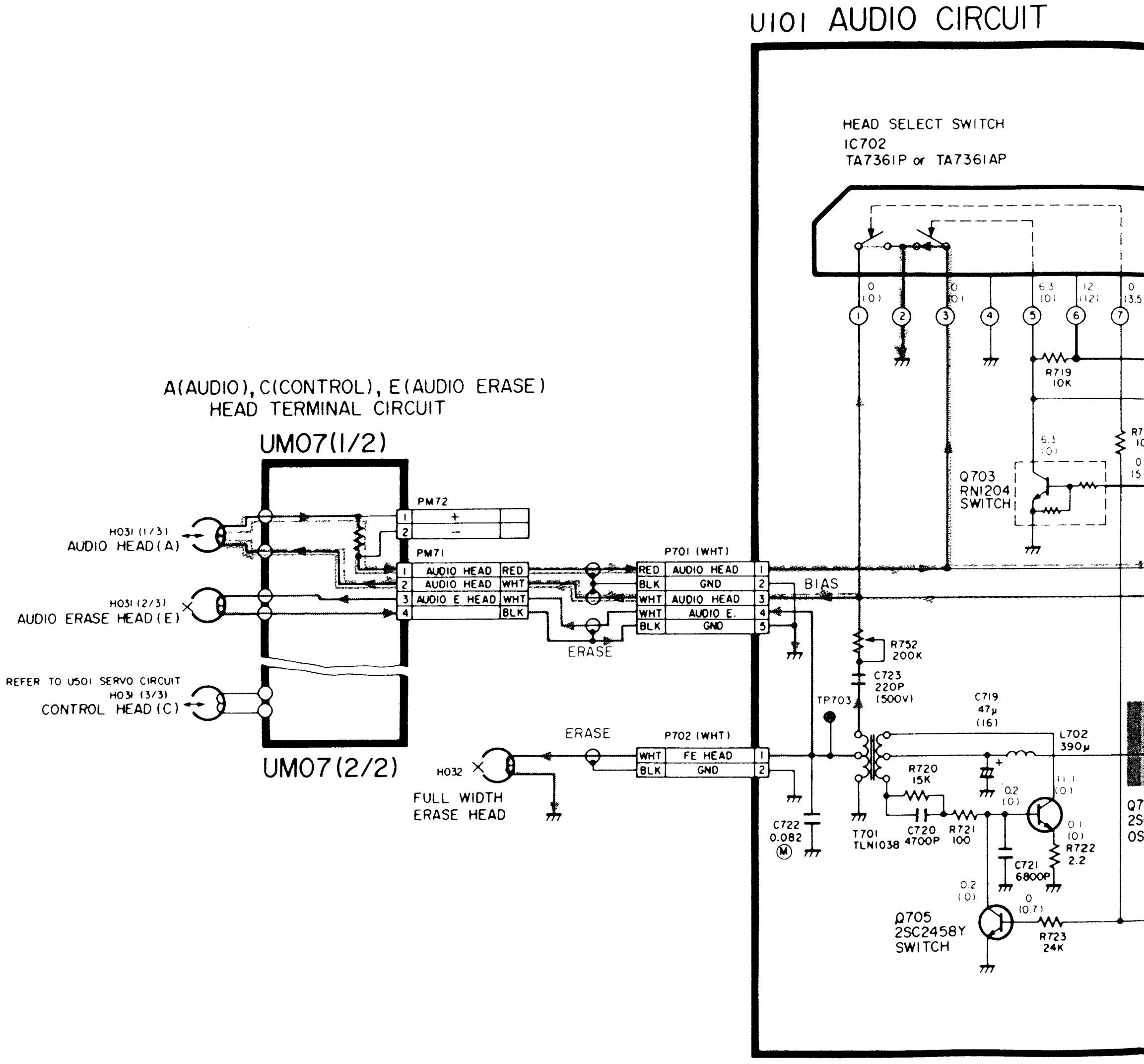
V: REC
( )V: PLAY

Symbol No.	Voltage (Unit: V) E	C	B	Location
Q703	0	6.3(0)	0(5)	G-5
Q704	0.1(0)	11.1(0)	0.2(0)	E-4
Q705	0	0.2(0)	0(0.7)	F-4
Q706	0	0(12)	6.3(0)	G-5

U101 AUDIO PC BOARD


P702
2
1
To H032 Full Width Erase Head
T
PM72
PM71
TLC134
A-C-HEAD
A.E
A.C
70193870
BIAS
PB LEVEL
70193846
TP701
TP703
TPG71
C722
C723
R725
R752
R751
C706
C707
R708
R709
R705
R707
R706
R711
C705
C704
R704
R710
C708
Z701
R714
C711
R712
C712
IC701
AUDIO
R720
C720
R721
R722
Q704
C719
Q705
C721
L702
C701
R716
R702
R703
C702
C703
C716
C717
C724
R713
R726
C714
R715
C713
L701
C715
Q703
Q706
R718
R719
R727
IC702
TLC-347

14-3. Audio Circuit

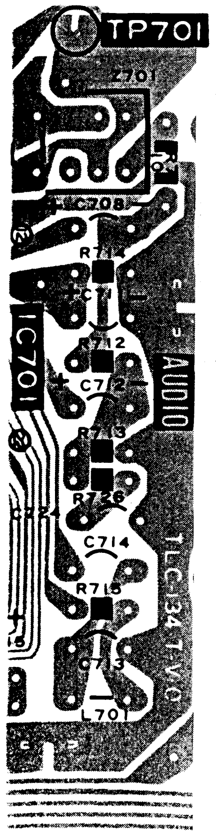

U101 AUDIO CIRCUIT
A(AUDIO), C(CONTROL), E(AUDIO ERASE) HEAD TERMINAL CIRCUIT
UM07(1/2)
UM07(2/2)
H031 (1/3) AUDIO HEAD (A)
H031 (2/3) AUDIO ERASE HEAD (E)
REFER TO U501 SERVO CIRCUIT H031 (3/3) CONTROL HEAD (C)
PM72
PM71
AUDIO HEAD RED
AUDIO HEAD WHT
AUDIO E HEAD WHT
BLK
P701 (WHT)
RED AUDIO HEAD
BLK GND
WHT AUDIO HEAD
WHT AUDIO E.
BLK GND
ERASE
BIAS
H032
FULL WIDTH ERASE HEAD
P702 (WHT)
WHT FE HEAD
BLK GND
HEAD SELECT SWITCH
IC702
TA7361P or TA7361AP
Q703 RN1204 SWITCH
R719 10K
R752 200K
C723 220P (500V)
TP703
C719 47μ (16)
L702 390μ
R720 15K
T701 TLN1038
C720 4700P
R721 100
C721 6800P
R722 2.2
C722 0.082
Q705 2SC2458Y SWITCH
R723 24K

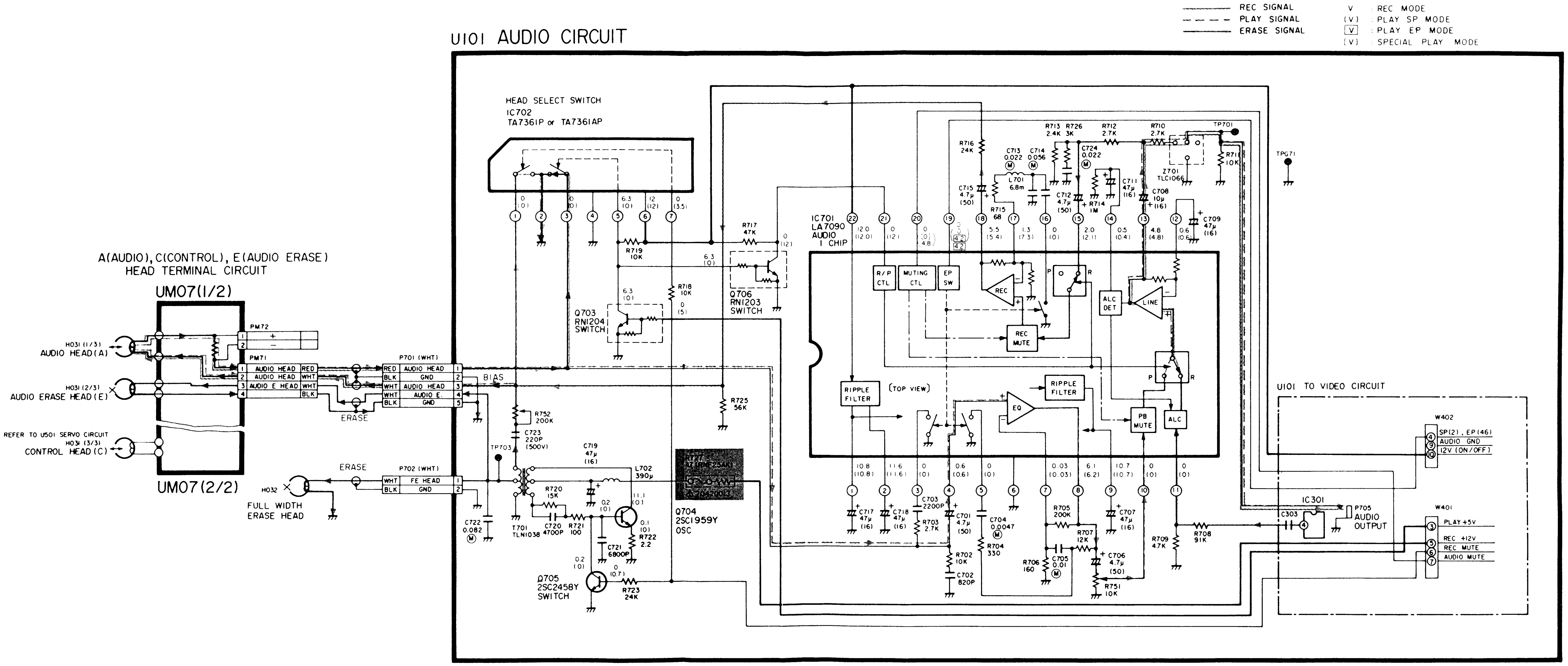
14-3. Audio Circuit

REC
LAY

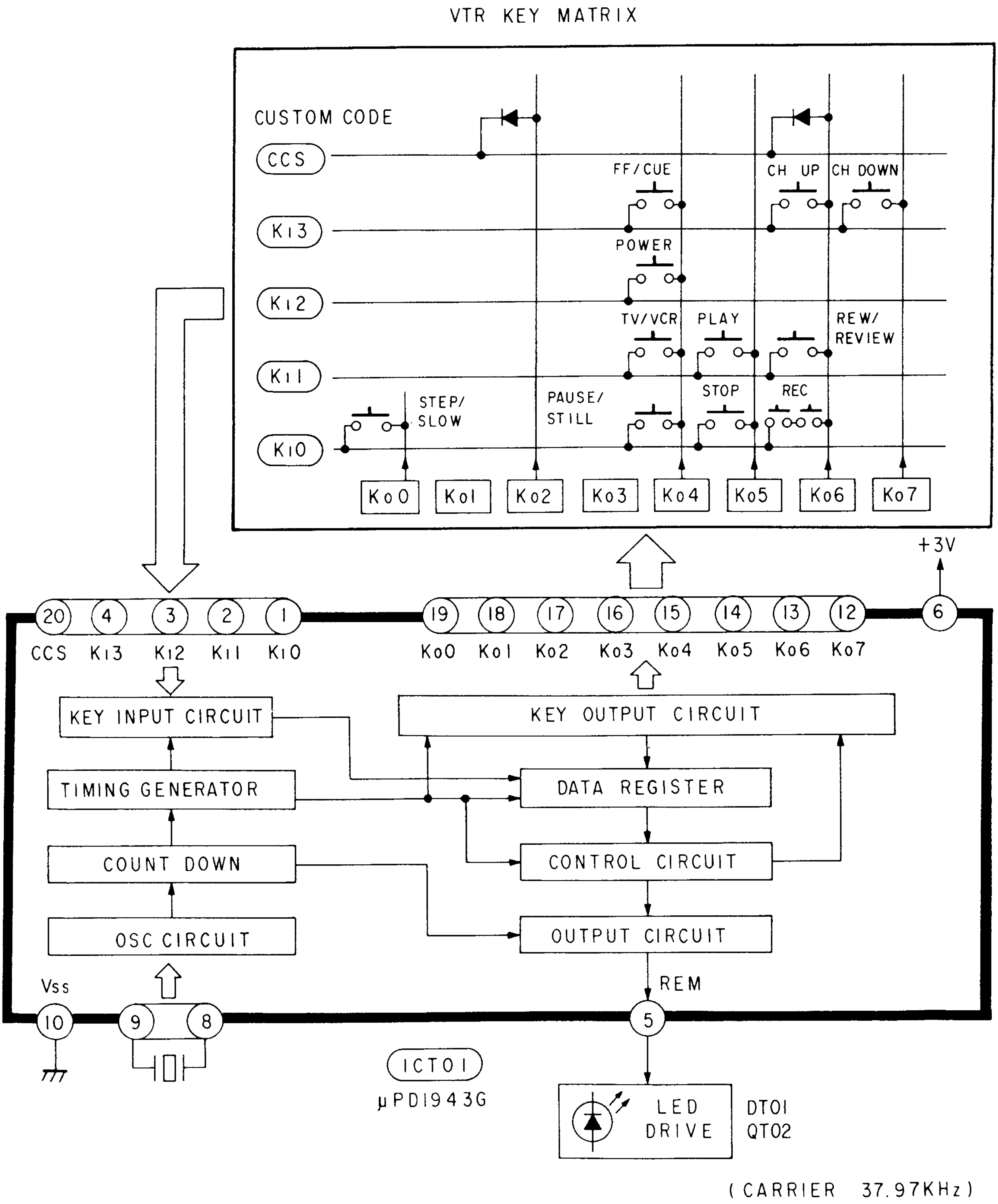
tion
5
4
4
5

7019 3846
Toshiba

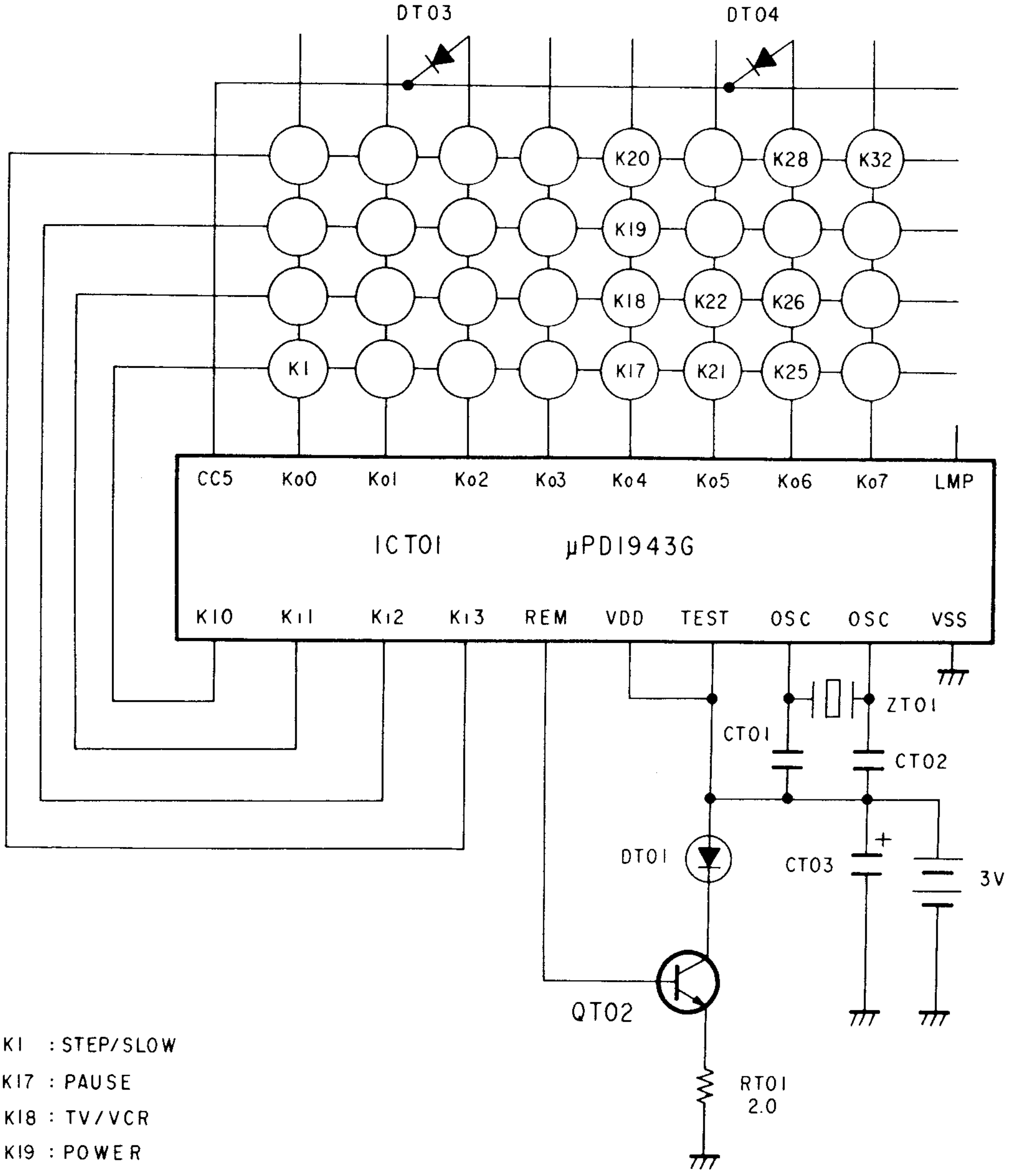

TP701
Z701
IC701
AUDIO
TLC1341V0
R714
R712
C712
R713
R726
C714
R716
C713
L701


REC SIGNAL
PLAY SIGNAL
ERASE SIGNAL
V : REC MODE
(V) : PLAY SP MODE
[V] : PLAY EP MODE
(V) : SPECIAL PLAY MODE
U101 AUDIO CIRCUIT
HEAD SELECT SWITCH
IC702
TA7361P or TA7361AP
A(AUDIO), C(CONTROL), E(AUDIO ERASE)
HEAD TERMINAL CIRCUIT
UM07(1/2)
UM07(2/2)
H031 (1/3)
AUDIO HEAD (A)
H031 (2/3)
AUDIO ERASE HEAD (E)
REFER TO U501 SERVO CIRCUIT
H031 (3/3)
CONTROL HEAD (C)
H032
FULL WIDTH
ERASE HEAD
PM72
PM71
AUDIO HEAD
AUDIO E HEAD
P701 (WHT)
GND
AUDIO E.
BIAS
ERASE
P702 (WHT)
FE HEAD
R719 10K
R718 10K
Q703 RN1204 SWITCH
R717 47K
Q706 RN1203 SWITCH
R725 56K
R752 200K
C723 220P (500V)
TP703
C719 47μ (16)
L702 390μ
R720 15K
C720 4700P
R721 100
C722 0.082
T701 TLN1038
C721 6800P
R722 2.2
Q704 2SC1959Y OSC
Q705 2SC2458Y SWITCH
R723 24K
IC701 LA7090 AUDIO 1 CHIP
R716 24K
C713 0.022
C714 0.056
R713 2.4K
R726 3K
R712 2.7K
C724 0.022
R710 2.7K
TP701
R711 10K
Z701 TLC1066
C715 4.7μ (50)
L701 6.8m
R715 68
C712 4.7μ (50)
R714 1M
C711 47μ (16)
C708 10μ (16)
C709 47μ (16)
TPG71
R/P CTL
MUTING CTL
EP SW
REC
REC MUTE
ALC DET
LINE
RIPPLE FILTER
(TOP VIEW)
EQ
PB MUTE
ALC
C717 47μ (16)
C718 47μ (16)
C703 2200P
R703 2.7K
C701 4.7μ (50)
C704 0.0047
R704 330
R702 10K
C702 820P
R705 200K
R707 12K
R706 160
C705 0.01
C706 4.7μ (50)
R751 10K
C707 47μ (16)
R709 4.7K
R708 91K
IC301
C303
P705 AUDIO OUTPUT
U101 TO VIDEO CIRCUIT
W402
SP(2), EP(46)
AUDIO GND
12V (ON/OFF)
W401
PLAY +5V
REC +12V
REC MUTE
AUDIO MUTE

15-1. Remote Control Block Diagram


VTR KEY MATRIX
CUSTOM CODE
CCS
Ki3
Ki2
Ki1
Ki0
FF/CUE
CH UP
CH DOWN
POWER
TV/VCR
PLAY
REW/
REVIEW
STEP/
SLOW
PAUSE/
STILL
STOP
REC
Ko0
Ko1
Ko2
Ko3
Ko4
Ko5
Ko6
Ko7
+3V
20
4
3
2
1
19
18
17
16
15
14
13
12
6
CCS
Ki3
Ki2
Ki1
Ki0
Ko0
Ko1
Ko2
Ko3
Ko4
Ko5
Ko6
Ko7
KEY INPUT CIRCUIT
KEY OUTPUT CIRCUIT
TIMING GENERATOR
DATA REGISTER
COUNT DOWN
CONTROL CIRCUIT
OSC CIRCUIT
OUTPUT CIRCUIT
Vss
REM
10
9
8
5
ICT01
μPD1943G
LED
DRIVE
DT01
QT02
(CARRIER 37.97KHz)

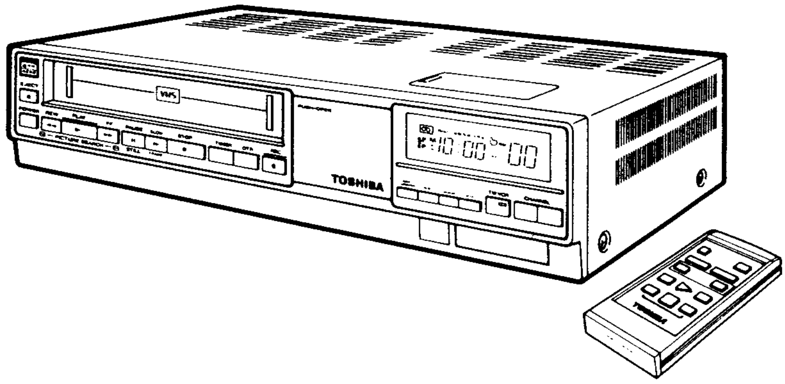
15-2. Remote Control Circuit


DT03
DT04
K20
K28
K32
K19
K18
K22
K26
K1
K17
K21
K25
CC5
Ko0
Ko1
Ko2
Ko3
Ko4
Ko5
Ko6
Ko7
LMP
ICT01
μPD1943G
Ki0
Ki1
Ki2
Ki3
REM
VDD
TEST
OSC
OSC
VSS
ZT01
CT01
CT02
DT01
CT03
3V
QT02
RT01
2.0

K1 : STEP/SLOW
K17 : PAUSE
K18 : TV/VCR
K19 : POWER
K20 : FF/CUE
K21 : STOP
K22 : PLAY
K25 : REC
K26 : REW/ REVIEW
K28 : CH. UP
K32 : CH. DOWN

SERVICE DATA
FILE NO. 030-145-3

TOSHIBA
COLOR VIDEO CASSETTE RECORDER
M-5530TL
PARTS LIST



SPECIFICATIONS

GENERAL
Video recording system: Rotary 2-head helical scanning
Head configuration: 4-head rotary (Dedicated heads for SP & EP)
Video signal: EIA standard NTSC color
Storage temperature: −20°C to +60°C (−4°F to +140°F)
Operating temperature: 5°C to 40°C (41°F to 104°F)
Antenna: 75 ohms external antenna terminal for VHF
300 ohms external antenna terminal for UHF
Channel coverage: VHF channels 2 – 13
UHF channels 14 – 83
CATV channels A_2, A_1, A – I, J – W, AA – JJ
VHF output signal: Channel 3 or 4 (selectable)
73 dBμ, 75 ohms unbalanced

SETTING POSITION	CHANNEL
VL ch	2 – 6
VH ch	A_2, A_1, A – I, 7 – 13
U ch	14 – 83
CATV ch	J – W, AA – JJ

Power consumption: 34W (8W with power off)
Weight: 17.2 lb.
Dimensions: 16-15/16 x 3-3/4 x 14-3/4 inches (W.H.D)

VIDEO
Input: VIDEO LINE IN:
Phono jack
1.0V(p-p)
75 ohms unbalanced, sync. negative

VIDEO
Output: VIDEO LINE OUT:
Phono jack
1.0V(p-p) 75 ohms unbalanced, sync. negative
Signal to noise ratio: [SP]: 45 dB

AUDIO
Input: AUDIO LINE IN:
Phono jack, 47k ohms, −10 dBs, unbalanced
Output: AUDIO LINE OUT:
Phono jack, less than 10k ohms, −7 dBs, unbalanced
(load: more than 47k ohms)
Frequency response: [SP]: 80 Hz to 12 kHz
Signal to noise ratio: [SP]: Better than 40 dB

TAPE TRANSPORT
Tape speed: SP 33.35 mm/sec., LP16.67 mm/sec., EP 11.12 mm/sec.
Maximum recording time: 480 min. with T-160 tape (EP mode)
Fast forward time: Within 5.0 min. (T-120)
Rewind time: Within 5.0 min. (T-120)

TIMER
Fluorescent digital display
Count down from AC line frequency.

Remote Control Unit
12 key: 17 modes. Infared Remote Control Operation

Design and specifications are subject to change without notice.

Caution: The unauthorized recording of television programmes and other materials may infringe on the rights of others.

SAFETY NOTICE

SAFETY PRECAUTIONS

LEAKAGE CURRENT CHECK

Plug the AC line cord directly into a 120V AC outlet (do not use an isolation transformer for this check). Use an AC voltmeter, having 5000 ohms per volt or more sensitivity.

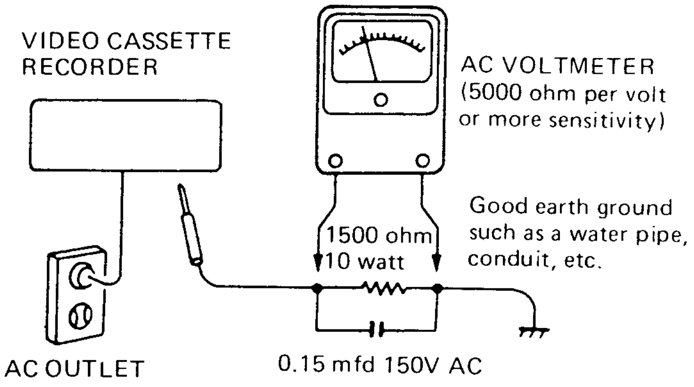
Connect a 1500 ohm 10 watt resistor, paralleled by a 0.15 mfd 150V AC capacitor between a known good earth ground (water pipe, conduit, etc.) and all exposed metal parts of cabinet (antennas, handle bracket, metal cabinet, screwheads, metal overlays, control shafts, etc.).

Measure the AC voltage across the 1500 ohm resistor. The test must be conducted with the AC switch on and then repeated with the AC switch off. The AC voltage indicated by the meter may not exceed 0.3 volts. A reading exceeding 0.3 volts indicates that a dangerous potential exists, the fault must be located and corrected.

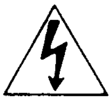
Repeat the above test with the VCR power plug reversed.

NEVER RETURN A VCR TO THE CUSTOMER WITHOUT TAKING NECESSARY CORRECTIVE ACTION.

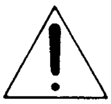
READING SHOULD NOT EXCEED 0.3V


VIDEO CASSETTE RECORDER
AC VOLTMETER (5000 ohm per volt or more sensitivity)
1500 ohm 10 watt
Good earth ground such as a water pipe, conduit, etc.
AC OUTLET
0.15 mfd 150V AC

Test all exposed metal.
Voltmeter Hook-up for Leakage Current Check



The lightning flash with arrowhead symbol, within an equilateral triangle, is intended to alert the user to the presence of uninsulated "dangerous voltage" within the product's enclosure that may be of sufficient magnitude to constitute a risk of electric shock to persons.



The exclamation point within an equilateral triangle is intended to alert the user to the presence of important operating and maintenance (servicing) instructions in the literature accompanying the appliance.

CONTENTS

1. Exploded Views
(1) Packing Assembly 2
(2) Cabinet Assembly 3
(3) Chassis Assembly. 4
(4) Cassette Holder Assembly 5
(5) Mechanical Parts (1). 6
(6) Mechanical Parts (2). 7
(7) Mechanical Parts (3). 8
2. Mechanical Parts List 9
3. Electrical Parts List 11

SAFETY PRECAUTION

The parts identified by shading and ⚠ mark are critical for safety. Replace only with part number specified. The mounting position of replacement is to be identical with originals. The substitute replacement parts which do not have the same safety characteristics as specified in the parts list may create shock, fire or other hazards.

ABBREVIATIONS

1. Integrated circuit (IC)

2. Capacitor (Cap)

MF··········microfarad
PF··········picofarad(micro-microfarad)

3. Resistor (Res)

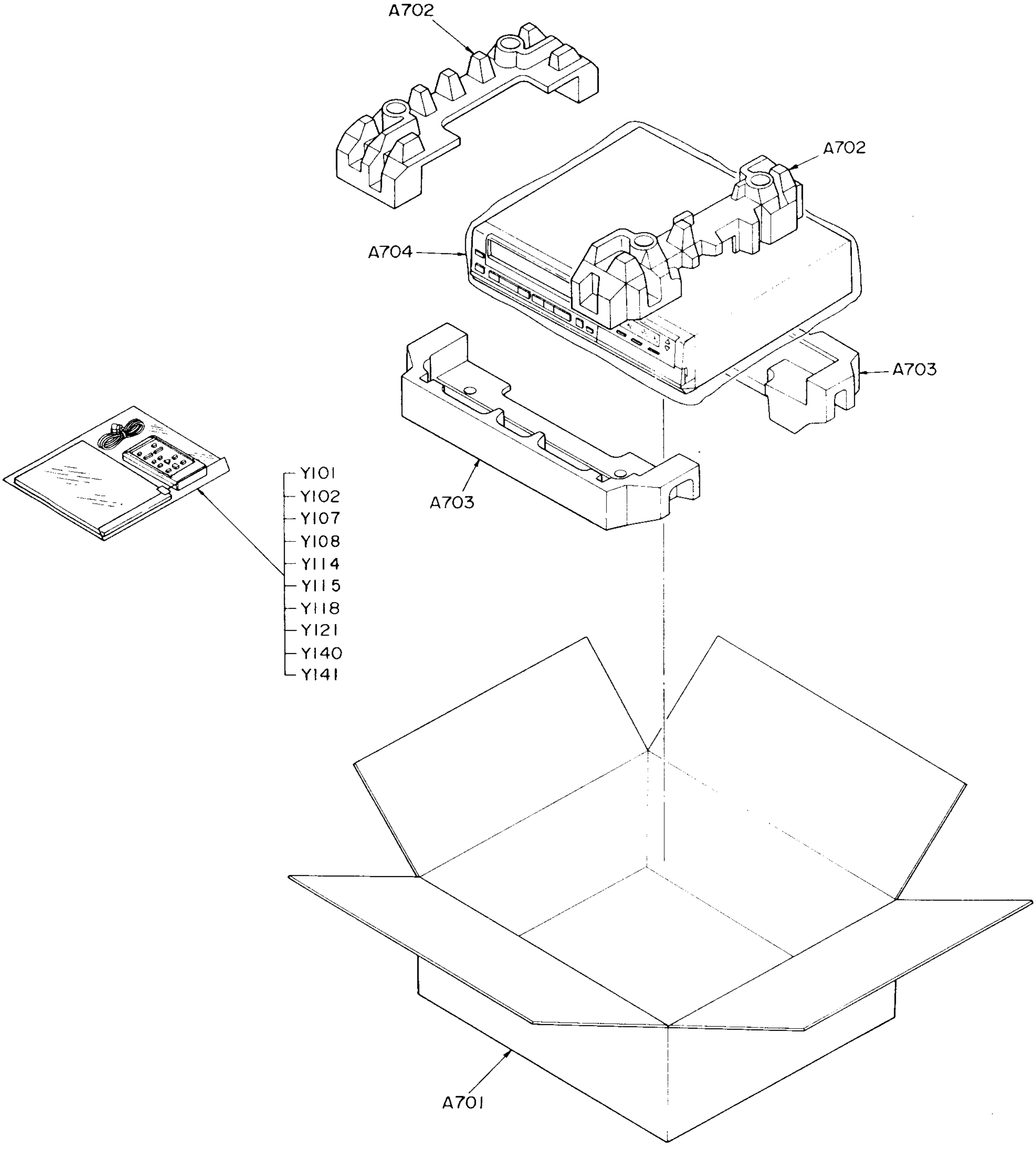
All resistance values are in ohms.
K ··········Kilo(1000)
M ··········Mega(1000000)
W ··········Watt

4. Tolerance

Symbol	G	J	K	M	N	Z	P	A
%	± 2	± 5	±10	±20	±30	+80 -20	+100 -0	+100 -10

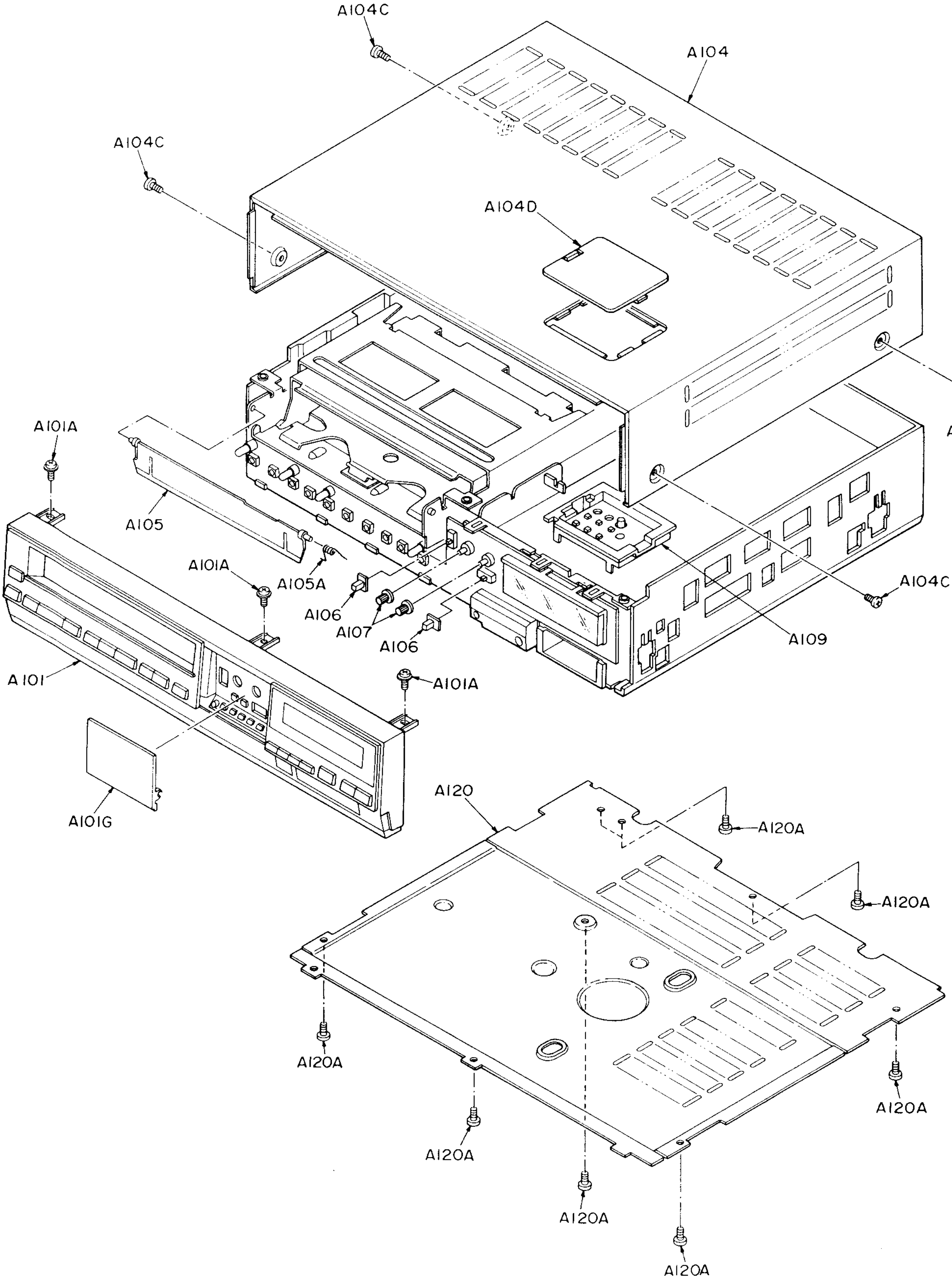
1.Exploded Views

(1) Packing Assembly

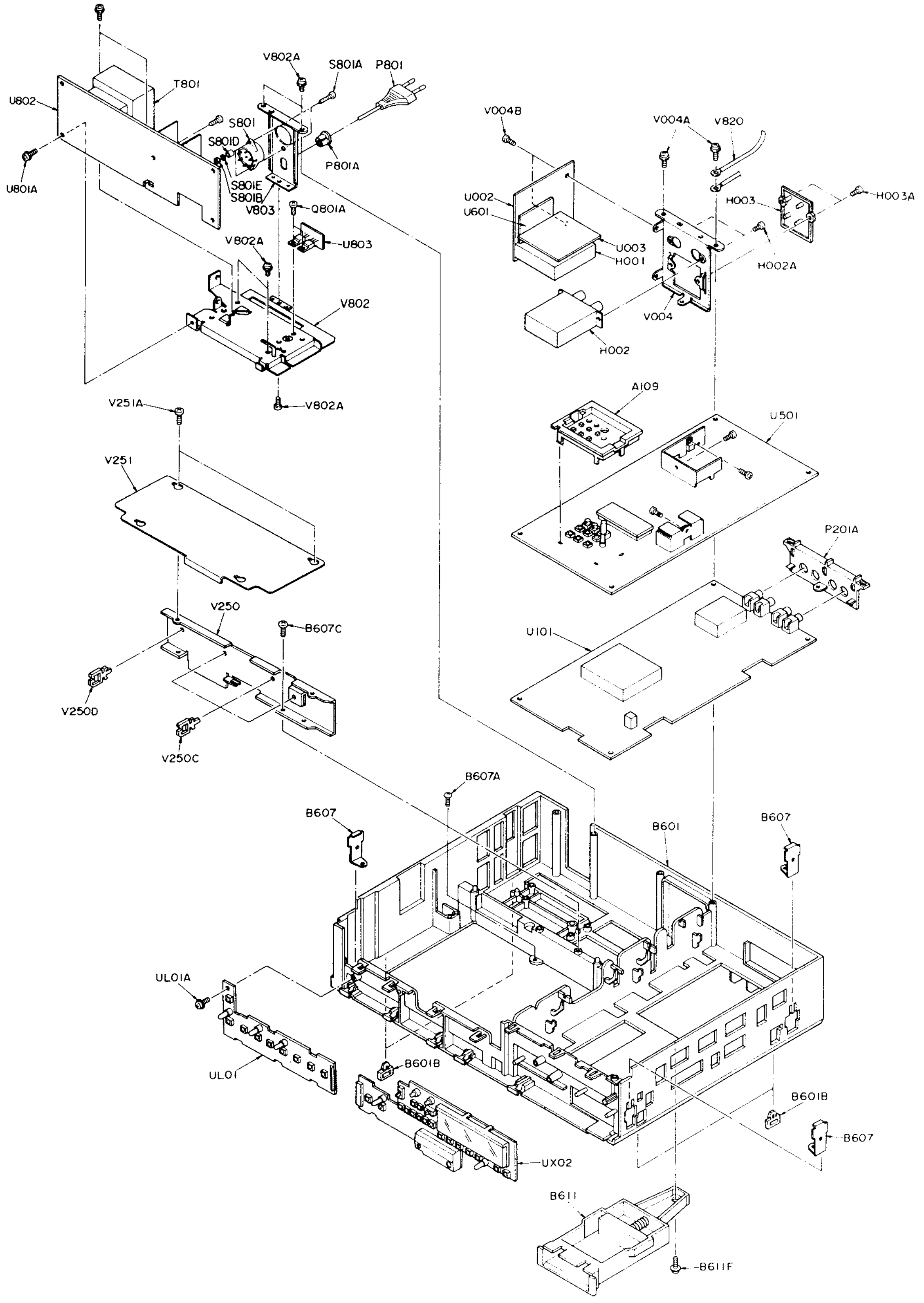


A702
A702
A704
A703
A703
Y101
Y102
Y107
Y108
Y114
Y115
Y118
Y121
Y140
Y141
A701

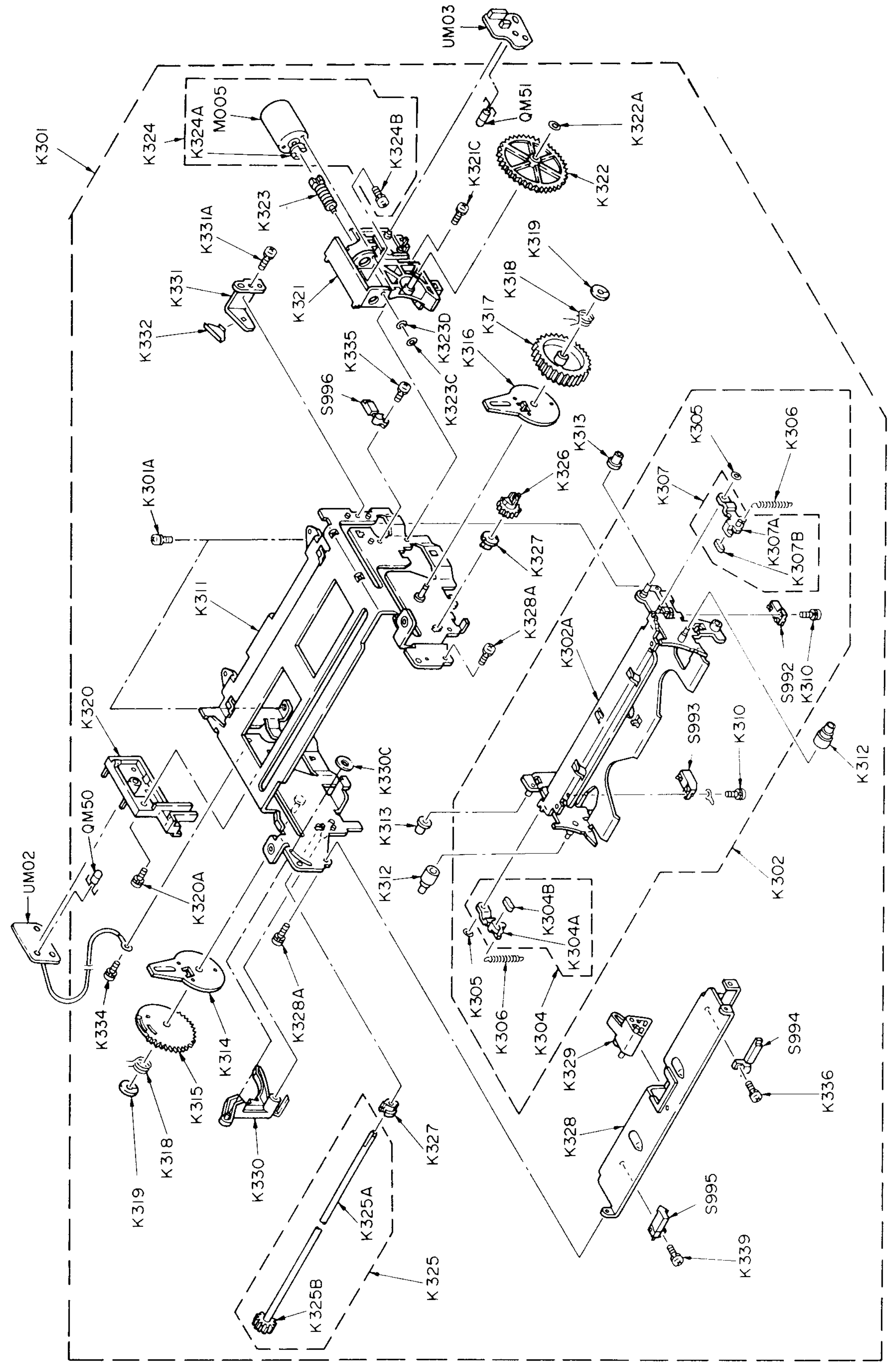
(2) Cabinet Assembly


A104C
A104
A104C
A104D
A101A
A104C
A105
A101A
A105A
A104C
A106
A107
A106
A109
A101
A101A
A101G
A120
A120A
A120A
A120A
A120A
A120A
A120A
A120A

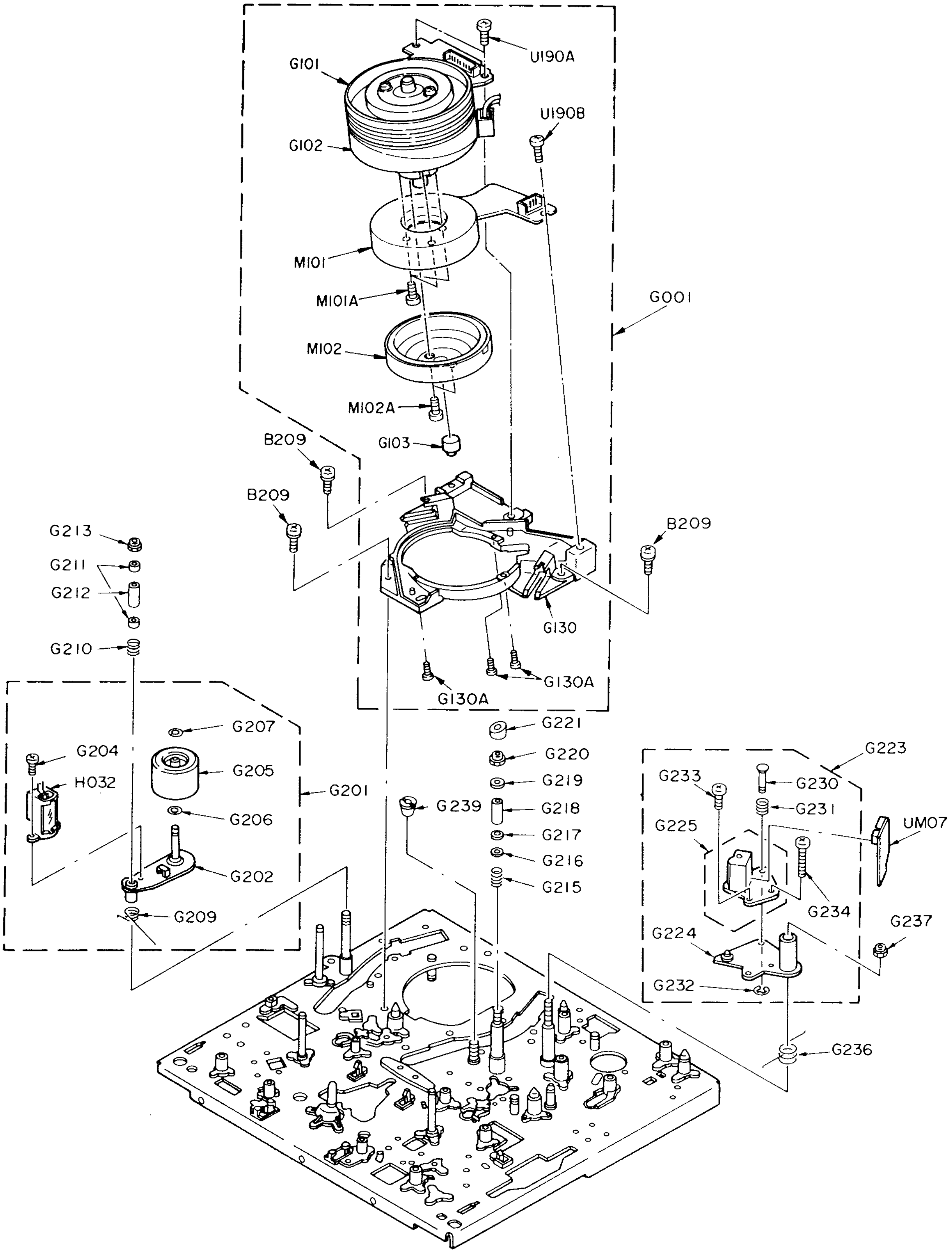
(3) Chassis Assembly


T801
U802
V802A
S801A
P801
S801
S801D
U801A
S801E
S801B
V803
P801A
Q801A
U803
V802A
V802
V802A
V004B
V004A
V820
U002
U601
U003
H001
H003
H003A
H002A
V004
H002
A109
U501
V251A
V251
P201A
V250
B607C
U101
V250D
V250C
B607A
B607
B601
B607
UL01A
UL01
B601B
B601B
B607
UX02
B611
B611F

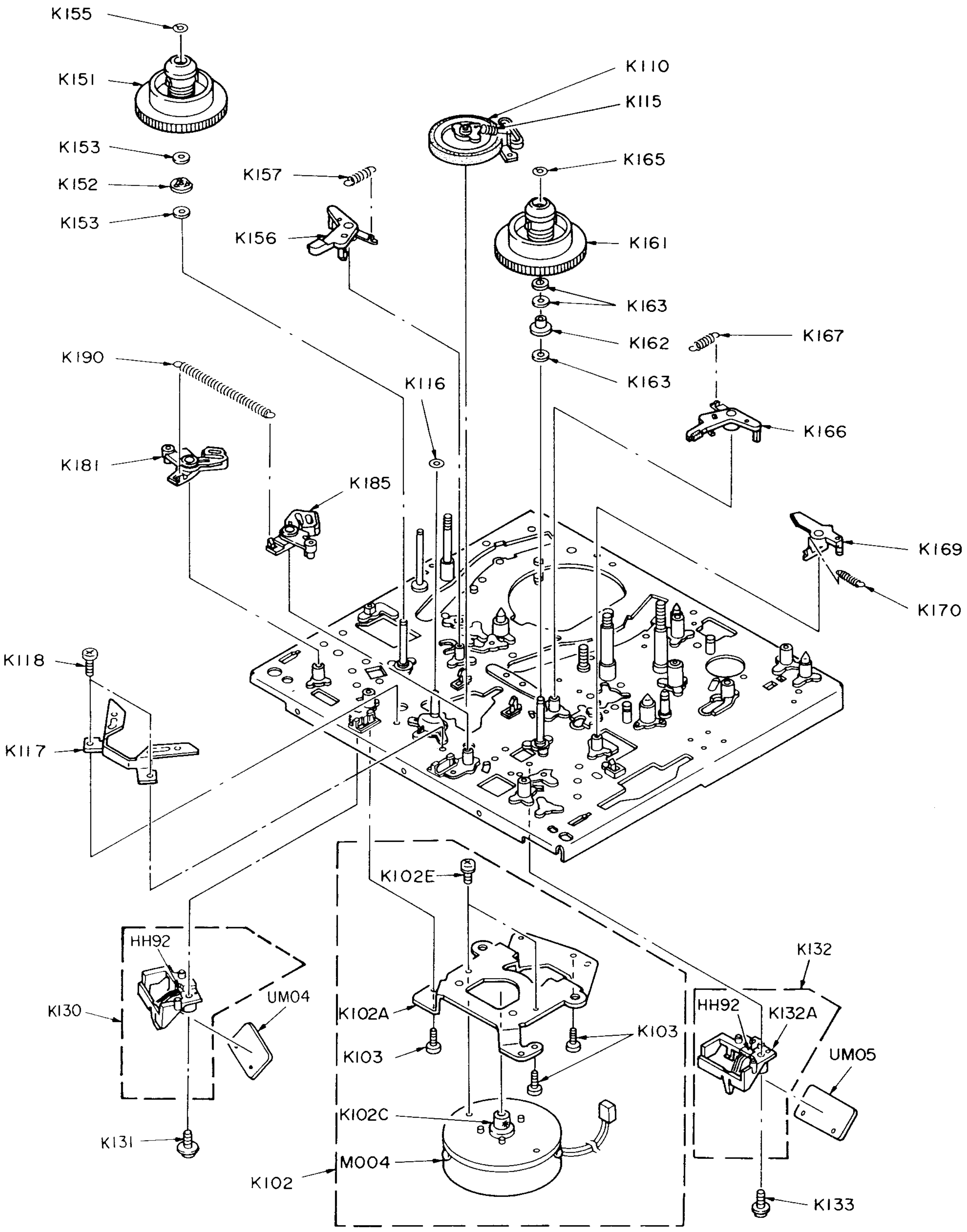
(4) Cassette Holder Assembly


UM03
K301
K324
K324A
M005
K324B
QM51
K322A
K321C
K322
K323
K331A
K331
K321
K319
K318
K332
K317
K323D
K323C
K316
K335
S996
K313
K305
K306
K301A
K326
K307
K307A
K307B
K327
K311
K328A
K302A
S992
K310
K320
S993
K310
K312
K330C
K313
QM50
UM02
K312
K302
K320A
K304B
K304A
K305
K306
K304
K334
K328A
K314
K315
K318
K319
K329
S994
K336
K328
K330
K327
K325A
S995
K339
K325
K325B

(5) Mechanical Parts List (1)


U190A
G101
U190B
G102
M101
M101A
G001
M102
M102A
B209
G103
B209
B209
G213
G211
G212
G210
G130
G130A
G130A
G207
G221
G204
G220
G223
H032
G205
G233
G219
G230
G201
G239
G218
G231
G206
UM07
G225
G217
G216
G202
G215
G234
G209
G237
G224
G232
G236

(6) Mechanical Parts List (2)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K116
K166
K181
K185
K169
K170
K118
K117
K102E
HH92
K132
K130
UM04
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HH92
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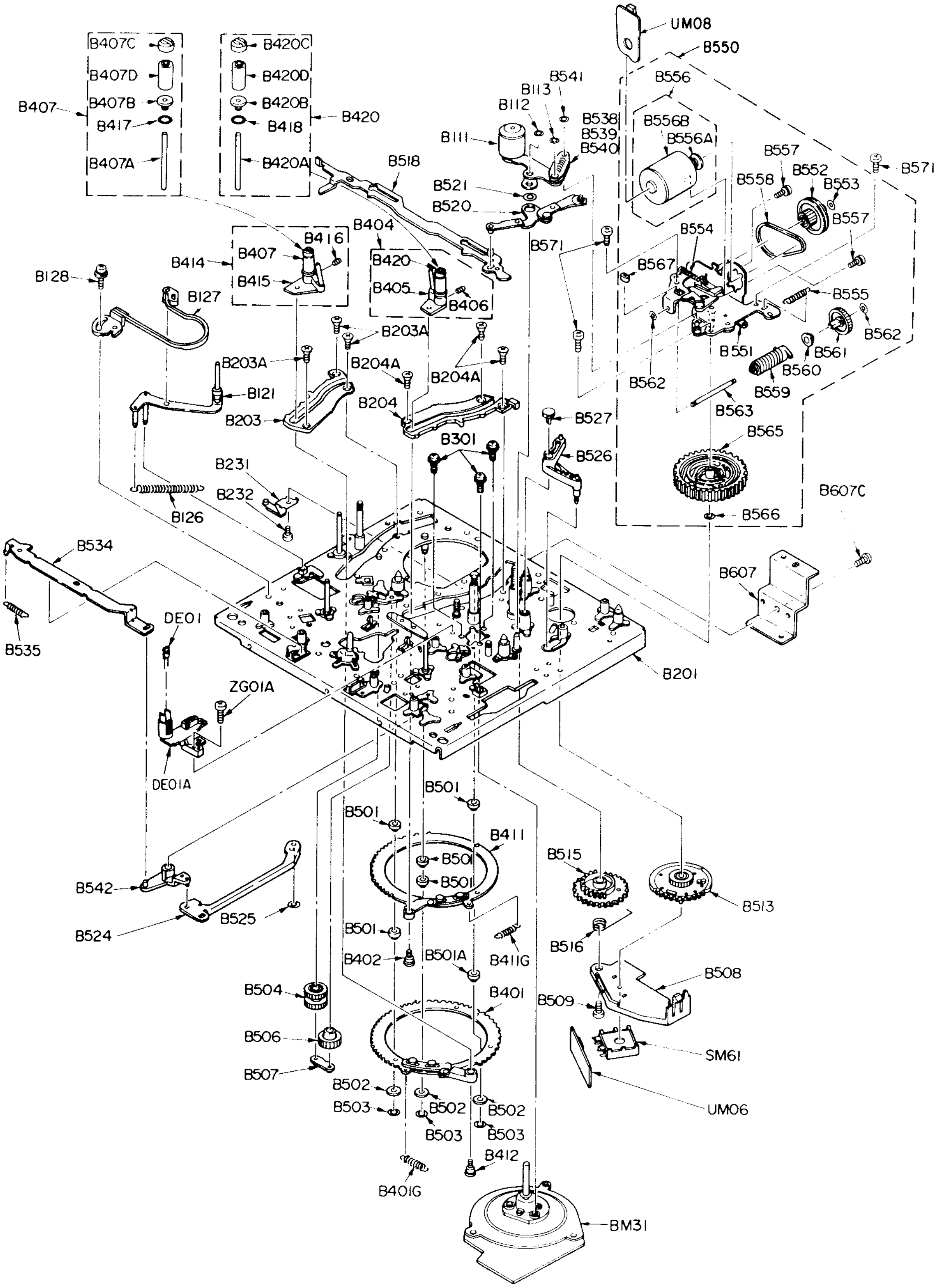
K103
K103
UM05
K102C
K131
M004
K102
K133

(7) Mechanical Parts List (3)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B571
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B402
B501A
B411G
B504
B401
B509
B506
SM61
B507
B502
B503
B502
B502
B503
B503
UM06
B412
B401G
BM31

2.Mechanical Parts List

NOTICE:The part number must be used when ordering parts, in order to assist in processing, be sure to include the model number and description.

LOCATION NUMBER	PART NUMBER	DESCRIPTION
	(1) Packing Assembly	
A701	70913469	Case
A702	70921176	Packing(U)
A703	70921177	Packing(L)
A704	70933058	Cover
Y101	70941595	Owner's Manual
Y102	70942463	Caution Sheet
Y107	23293974	Matching Trans.AD709JB
Y108	23363476	Flat Cable.300 OHM
Y114	70164081	AC Plug Converter
Y115	70168072	F-PAL Type Cable
Y118	23293982	Matching Trans.ADB-AD909F
Y140	70148163	Remote Control Unit.VC-55G
	(2) Cabinet Assembly	
A101	70812481	Front Panel
A101G	70863435	Door
A101M	23848226	Push-Catch
A104	70824224	Top Cover
A104C	23774306	Screw. 3X0. 5X6mm
A104D	70863466	Door
A105	70863438	Cassette Door
A105A	70351679	Spring
A107	70816797	Knob
	(3) Chassis Assembly	
A109	70843178	Cover
H001	70121056	Tuner.EL623
H002	70123083	RF MOD.MSU911A
H003	23142559	ANT Terminal.VT818
H003A	23035308	Screw.3x8mm
P201A	70843199	Holder
⚠P801	23176755	Power Cord
⚠P801A	70846159	Cord Holder
⚠S801	23367055	Switch
S801D	23056300	Washer
S801E	70867440	Spacer
⚠T801	23213700	Transformer.TPW1360AN
V004A	70391081	Screw. 4x12mm
V250A	70391081	Screw. 4x12mm
V251A	70391049	Screw. 3x8mm
V802A	70391081	Screw. 4x12mm
U002	70194682	P.C.Board Ass'y.PIF
U003	70194683	P.C.Board Ass'y.AFT
U101	70194680	P.C.Board Ass'y.VIDEO.AUDIO
U501	70194681	P.C.Board Ass'y.SERVO.LOGIC
U802	70194812	P.C.Board Ass'y.POWER 1
U803	70194813	P.C.Board Ass'y.POWER TR
UL01	70194686	P.C.Board Ass'y.LOGIC SW
UX02	70194687	P.C.Board Ass'y.TIMER DISPLAY
	(4) Cassette Holder Assembly	
K301	70314236	Front Loading Assy
K301A	70391049	Screw. 3x8mm
K305	70396151	Washer.Fl 2. 6
K310	23723204	Screw. 2x4mm
K319	70396187	Washer.Fl 3. 6x12x0. 5mm
K321C	23723310	Screw. 3x10mm
K323	70324321	Worm Gear Assy
K323C	70396152	Washer.Fl 1. 6
K323D	70396050	Washer.3.9x2.1x0.5mm
K324	70324323	Motor Assy
K327	70338073	Bearing
K328A	23723264	Screw. 2. 6x4mm
K334	23723264	Screw. 2. 6x4mm
K335	23723205	Screw. 2. 5x5mm
M005	70125069	DC Motor.12V
QM50	70114347	Photo Transistor.PN202-S
QM51	70114345	Photo Transistor.PN202S-R
S992	23145486	Leaf Switch.(R)
S993	23145487	Leaf Switch.(L)
S994	23145485	Leaf Switch
S995	23145484	Leaf Switch
S996	23145565	Leaf Switch
	(5) Mechanical Parts(1)	
G001	70311283	Cylinder Assy.C3W4N
G101	70321904	Upper Cylinder Ass'y
G102	70321861	Lower Cylinder Ass'y
G103	70321601	Ground Cap Ass'y
G204	70391351	Screw. 2. 6x8mm
G205	70346031	Impedance.Roller.Assy
G206	70396050	Washer.3.9x2.1x0.5mm
G207	70396190	Washer.Fl 1. 6x6x0 . 5mm
G209	70351694	Spring
G213	70393025	NUT. 3x3mm
G220	70393025	NUT. 3x3mm
G225	70182056	ACE Sub Base Assy
G234	70391322	Adjust Screw
G236	70351666	Spring
G237	70393026	NUT. 3x4. 5mm
H032	70183032	FE Head
M101	70125199	Stator
M102	70125198	Rotor
	(6) Mechanical Parts(2)	
HH91	A6090130	Hall Sensor.THS103A
HH92	A6090130	Hall Sensor.THS103A
K102	70326539	Reel Motor Assy
K110	70326538	Idler Assy
K118	23723264	Screw. 2. 6x4mm
K130	70316141	S Sensor Assy
K132	70316142	T Sensor Assy
K151	70317033	S Reel Rest Assy
K152	70338075	Bearing
K153	70394153	Spacer
K155	70396193	Washer.Fl 2. 6x6x0 . 5mm
K156	70363300	Lever
K161	70317034	T Reel Rest Assy
K162	70338077	Spacer
K163	70394153	Spacer
K163B	70394155	Washer.3x 8x 0. 1mm
K165	70396193	Washer.Fl 2. 6x6x0 . 5mm
K166	70326535	Lever Assy
K167	70351685	Spring
K169	70326533	Reverse Brake Assy
K170	70351706	Spring
K181	70326536	S Brake Assy
K185	70326537	T Brake Assy
K190	70351684	Spring
	(7) Mechanical Parts(3)	
B101	70321854	Lever Assy
B101M	70351689	Spring
B104	70396193	Washer.Fl 2. 6x6x0 . 5mm
B111	70323310	Pinch Roller Assy
B111C	70378597	Shaft
B112	70396196	Washer.Fl 3. 6x8x0 . 5mm
B113	70396193	Washer.Fl 2. 6x6x0 . 5mm
B121	70328319	Tension Lever Assy
B126	70351687	Spring
B127	70321842	Band Brake Assy
B210	70391081	Screw. 4x12mm
B231	70321858	Earth Brush Assy
B232	70391345	Screw. 3x3mm
B405	70311243	T Slider Sub Assy
B406	70391361	Screw. 2. 6x3mm

LOCATION NUMBER	PART NUMBER	DESCRIPTION
B407	70322328	Guide Roller Assy
B416	70391361	Screw, 2. 6x3㎜
B417	70353115	O-ring
B418	70353115	O-ring
B420	70322344	T Guide Roller Assy
B503	70396196	Washer,Fl 3. 6x8x0 . 5㎜
B504	70333198	Loading Ring Gear(A)
B506	70333199	Loading Ring Gear(B)
B507	70368116	Double Cap
B513	70333195	Phase Gear
B515	70333196	Loading Drive Gear
B516	70351676	Spring
B521	70347034	Polislider 4. 1x 6. 5x 0. 50㎜
B525	70396193	Washer,Fl 2. 6x6x0 . 5㎜
B535	70351683	Spring
B541	70396193	Washer,Fl 2. 6x6x0 . 5㎜
B542	70363305	Lever
B553	70396064	Washer,5.0x2.1x0.5
B554	70351641	Spring
B556	70312179	Loading Motor Assy
B556B	70125069	DC Motor,12V
B557	23723264	Screw, 2. 6x4㎜
B558	70342123	Loading Belt
B566	70396193	Washer,Fl 2. 6x6x0 . 5㎜
B607A	70391081	Screw, 4x12㎜
BM31	70125196	Motor,Capstan
DE01	70115406	Diode,LED GL450V

LOCATION NUMBER	PART NUMBER	DESCRIPTION

3.Electrical Parts List

NOTICE:The part number must be used when ordering parts, in order to assist in processing, be sure to include the model number and description.

LOCATION NUMBER	PART NUMBER	DESCRIPTION		
		PIF BOARD		
U002	70194682	P C Board Assy.PIF		
UHF/VHF TUNER				
H001	70121056	TUNER	EL623	
INTEGRATED CIRCUITS				
IC002	B0354710	IC	TA7607AP	
IC003	B0325290	IC	TA7337P	
TRANSISTORS				
Q001	A6708871	Transistor	2SC388ATM	
Q004	A6332430	Transistor	2SC2458-Y	
Q005	A6534430	Transistor	2SA1048-Y	
Q006	A6534430	Transistor	2SA1048-Y	
QB04	A6002040	Transistor	RN1204	
QB05	A6002020	Transistor	RN1202	
QB06	A6012020	Transistor	RN2202	
QB07	A6002020	Transistor	RN1202	
QB08	A6012020	Transistor	RN2202	
QB09	A6002020	Transistor	RN1202	
QB10	A6002020	Transistor	RN1202	
DIODES				
# D001	A7160570	Diode	1SS176	
COILS				
L001	23261980	Coil.Choke	TRF9225	
L002	23262828	Coil.PIF	TRF1065	
L003	23238739	Coil.Peaking	TRF4150AH	
L004	23237983	Coil.Peaking	TRF4220AC	
L006	23237933	Coil.Peaking	TRF4240AC	
L007	23252930	Coil.SIF	TRF6010	
L008	23262951	Coil.RF Choke	TRF1019	
L009	23251999	Coil.Choke	TRF9006	
L051	23262851	Coil.PIF	TRF1228	
L052	23262827	Coil.PIF	TRF1066	
CAPACITORS				
# C001	24232103	Cap.Ceramic	0.01MF	Z 16V
# C002	24232103	Cap.Ceramic	0.01MF	Z 16V
# C003	24232103	Cap.Ceramic	0.01MF	Z 16V
# C004	24232103	Cap.Ceramic	0.01MF	Z 16V
# C005	24232102	Cap.Ceramic	1000PF	Z 50V
C006	24636479	Cap.Electrolytic	4. 7MF	M 50V
# C007	24436159	Cap.Ceramic	1.5PF	J 50V
# C008	24436010	Cap.Ceramic	1.0PF	J 50V
# C009	24436120	Cap.Ceramic	12PF	J 50V
C010	24636478	Cap.Electrolytic	0. 47MF	M 50V
# C012	24436390	Cap.Ceramic	39PF	J 50V
C013	24636478	Cap.Electrolytic	0. 47MF	M 50V
# C014	24436470	Cap.Ceramic	47PF	J 50V
# C015	24436470	Cap.Ceramic	47PF	J 50V
# C016	24232103	Cap.Ceramic	0.01MF	Z 16V
# C017	24232103	Cap.Ceramic	0.01MF	Z 16V
C018	24794470	Cap.Electrolytic	47MF	M 16V
C019	24591103	Cap.Plastic	0. 01MF	J 50V
C020	24636229	Cap.Electrolytic	2. 2MF	M 50V
C022	24794470	Cap.Electrolytic	47MF	M 16V
# C023	24232103	Cap.Ceramic	0.01MF	Z 16V
# C026	24232103	Cap.Ceramic	0.01MF	Z 16V
# C027	24436189	Cap.Ceramic	1.8PF	J 50V
# C028	24436689	Cap.Ceramic	6.8PF	J 50V
# C030	24436270	Cap.Ceramic	27PF	J 50V
# C031	24436189	Cap.Ceramic	1.8PF	J 50V
CB01	24636339	Cap.Electrolytic	3. 3MF	M 50V
CB02	24636339	Cap.Electrolytic	3. 3MF	M 50V
RESISTORS				
# R001	24360910	Res.Carbon	91	J 1/8W
# R002	24360301	Res.Carbon	300	J 1/8W
# R003	24360562	Res.Carbon	5.6K	J 1/8W
# R004	24360152	Res.Carbon	1.5K	J 1/8W
# R005	24360391	Res.Carbon	390	J 1/8W
# R006	24360330	Res.Carbon	33	J 1/8W

LOCATION NUMBER	PART NUMBER	DESCRIPTION		
# R007	24360391	Res.Carbon	390	J 1/8W
# R008	24360221	Res.Carbon	220	J 1/8W
# R009	24360683	Res.Carbon	68K	J 1/8W
# R010	24360392	Res.Carbon	3.9K	J 1/8W
# R011	24360824	Res.Carbon	820K	J 1/8W
# R012	24360822	Res.Carbon	8.2K	J 1/8W
# R013	24360331	Res.Carbon	330	J 1/8W
# R014	24360511	Res.Carbon	510	J 1/8W
# R015	24360911	Res.Carbon	910	J 1/8W
# R016	24360242	Res.Carbon	2.4K	J 1/8W
# R017	24360471	Res.Carbon	470	J 1/8W
# R019	24360182	Res.Carbon	1.8K	J 1/8W
# R020	24360105	Res.Carbon	1M	J 1/8W
# R021	24360512	Res.Carbon	5.1K	J 1/8W
# R022	24360182	Res.Carbon	1.8K	J 1/8W
# R023	24360622	Res.Carbon	6.2K	J 1/8W
# R024	24360392	Res.Carbon	3.9K	J 1/8W
# R025	24360362	Res.Carbon	3.6K	J 1/8W
# R026	24360272	Res.Carbon	2.7K	J 1/8W
# R027	24360332	Res.Carbon	3.3K	J 1/8W
# R028	24360242	Res.Carbon	2.4K	J 1/8W
# R029	24360104	Res.Carbon	100K	J 1/8W
R030	24380132	Res.Carbon	1. 3K	J 1/8W
# RB05	24360393	Res.Carbon	39K	J 1/8W
# RB06	24360154	Res.Carbon	150K	J 1/8W
# RB27	24360105	Res.Carbon	1M	J 1/8W
R051	24066947	Res.Variable	500K	
R052	24066983	Res.Variable	5K	
MISCELLANEOUS				
Z001	A5610690	Filter.PIF.F1032B	45. 75MHz	
Z002	23107976	Video Trap	4. 5MHz	
Z003	23107980	Filter	4. 5MHz	
		AFT BOARD		
U003	70194683	P C Board Assy.AFT		
TRANSISTORS				
QB01	A6048350	Transistor.FET	2SK30ATM	
QB02	A6332430	Transistor	2SC2458-Y	
QB11	A6048370	Transistor.FET	2SK30ATMGR	
QB12	A6534430	Transistor	2SA1048-Y	
QB13	A6534430	Transistor	2SA1048-Y	
QB14	A6534430	Transistor	2SA1048-Y	
QB15	A6332440	Transistor	2SC2458-GR	
QB16	A6332430	Transistor	2SC2458-Y	
QB17	A6534430	Transistor	2SA1048-Y	
QB18	A6332440	Transistor	2SC2458-GR	
QB19	A6332430	Transistor	2SC2458-Y	
QB20	A6332430	Transistor	2SC2458-Y	
QB21	A6534440	Transistor	2SA1048-GR	
DIODES				
# DB01	A7160570	Diode	1SS176	
CAPACITORS				
# CB21	24232103	Cap.Ceramic	0.01MF	Z 16V
RESISTORS				
# RB01	24360105	Res.Carbon	1M	J 1/8W
# RB02	24360204	Res.Carbon	200K	J 1/8W
# RB03	24360203	Res.Carbon	20K	J 1/8W
# RB08	24360913	Res.Carbon	91K	J 1/8W
# RB09	24360913	Res.Carbon	91K	J 1/8W
# RB10	24360154	Res.Carbon	150K	J 1/8W
# RB11	24360154	Res.Carbon	150K	J 1/8W
# RB12	24360124	Res.Carbon	120K	J 1/8W
# RB13	24360393	Res.Carbon	39K	J 1/8W
# RB14	24360393	Res.Carbon	39K	J 1/8W
# RB15	24360103	Res.Carbon	10K	J 1/8W
# RB16	24360274	Res.Carbon	270K	J 1/8W
# RB17	24360274	Res.Carbon	270K	J 1/8W
# RB18	24360623	Res.Carbon	62K	J 1/8W
# RB19	24360363	Res.Carbon	36K	J 1/8W

Note: Part marked # are of chip type and mounted on original PC boards. However, when they are placed for servicing works, use discrete parts listed on the above parts list.

LOCATION NUMBER	PART NUMBER	DESCRIPTION		
# RB20	24360103	Res.Carbon	10K	J 1/8W
# RB21	24360105	Res.Carbon	1M	J 1/8W
# RB22	24360243	Res.Carbon	24K	J 1/8W
# RB23	24360103	Res.Carbon	10K	J 1/8W
# RB24	24360224	Res.Carbon	220K	J 1/8W
# RB25	24360244	Res.Carbon	240K	J 1/8W
# RB26	24360824	Res.Carbon	820K	J 1/8W
# RB28	24360154	Res.Carbon	150K	J 1/8W
# RB29	24360473	Res.Carbon	47K	J 1/8W
VIDEO.AUDIO BOARD				
U101	70194680	P C Board Assy.Video, Audio		
INTEGRATED CIRCUITS				
IC101	B0475122	IC	TC4512BP	
IC102	B0358220	IC	TA7772P	
IC103	B0358220	IC	TA7772P	
IC104	B0470045	IC	TC4013BAP	
IC105	B0357915	IC	TA7743P	
IC106	B0349250	IC	TA75393S	
IC201	70119506	IC	AN6337	
IC202	70119507	IC	AN6306	
IC203	B0357905	IC	TA7741P	
IC204	B0589100	IC	TL8610P	
IC301	B0470532	IC	TC4053BP	
IC401	70119453	IC	MN6163A	
IC402	70119452	IC	AN6366NK	
IC701	70119518	IC	LA7090	
IC702	B0325530	IC	TA7361P	
TRANSISTORS				
Q107	A6325540	Transistor	SC2236-Y	
Q108	A6002040	Transistor	RN1204	
Q109	A6332430	Transistor	2SC2458-Y	
Q110	A6332430	Transistor	2SC2458-Y	
Q111	A6002040	Transistor	RN1204	
Q113	A6002040	Transistor	RN1204	
Q114	A6002040	Transistor	RN1204	
Q116	A6012030	Transistor	RN2203	
Q117	A6012030	Transistor	RN2203	
Q118	A6012030	Transistor	RN2203	
Q120	A6012020	Transistor	RN2202	
Q121	A6332430	Transistor	2SC2458-Y	
Q122	A6332450	Transistor	2SC2458-BL	
Q123	A6332450	Transistor	2SC2458-BL	
Q124	A6332450	Transistor	2SC2458-BL	
Q125	A6332450	Transistor	2SC2458-BL	
Q127	A6534430	Transistor	2SA1048-Y	
Q128	A6002030	Transistor	RN1203	
Q129	A6002030	Transistor	RN1203	
Q130	A6332430	Transistor	2SC2458-Y	
Q131	A6534430	Transistor	2SA1048-Y	
Q205	A6332430	Transistor	2SC2458-Y	
Q206	A6002040	Transistor	RN1204	
Q207	A6534430	Transistor	2SA1048-Y	
Q208	A6534430	Transistor	2SA1048-Y	
Q209	A6534430	Transistor	2SA1048-Y	
Q210	A6534430	Transistor	2SA1048-Y	
Q211	A6534430	Transistor	2SA1048-Y	
Q212	A6534430	Transistor	2SA1048-Y	
Q213	A6332430	Transistor	2SC2458-Y	
Q214	A6012040	Transistor	RN2204	
Q215	A6534430	Transistor	2SA1048-Y	
Q216	A6002030	Transistor	RN1203	
Q217	A6012050	Transistor	RN2205	
Q218	A6332430	Transistor	2SC2458-Y	
Q219	A6332430	Transistor	2SC2458-Y	
Q220	A6533240	Transistor	2SA966-Y	
Q221	A6002030	Transistor	RN1203	
Q222	A6002040	Transistor	RN1204	
Q223	A6002040	Transistor	RN1204	
Q224	A6319020	Transistor	2SC1923-O	
Q302	A6534040	Transistor	2SA1015-Y	
Q303	A6332430	Transistor	2SC2458-Y	
Q304	A6332430	Transistor	2SC2458-Y	
Q399	A6534430	Transistor	2SA1048-Y	
Q403	A6534430	Transistor	2SA1048-Y	

LOCATION NUMBER	PART NUMBER	DESCRIPTION		
Q404	A6012030	Transistor	RN2203	
Q405	A6332430	Transistor	2SC2458-Y	
Q406	A6332430	Transistor	2SC2458-Y	
Q407	A6332430	Transistor	2SC2458-Y	
Q408	A6332430	Transistor	2SC2458-Y	
Q409	A6332430	Transistor	2SC2458-Y	
Q410	A6332430	Transistor	2SC2458-Y	
Q411	A6332430	Transistor	2SC2458-Y	
Q412	A6332430	Transistor	2SC2458-Y	
Q413	A6012040	Transistor	RN2204	
Q414	A6534430	Transistor	2SA1048-Y	
Q703	A6002040	Transistor	RN1204	
Q704	A6319300	Transistor	2SC1959-Y	
Q705	A6332430	Transistor	2SC2458-Y	
Q706	A6002030	Transistor	RN1203	
Q750	A6332430	Transistor	2SC2458-Y	
DIODES				
D101	A7151450	Diode	1SS200	
D102	A7151450	Diode	1SS200	
D103	A7160570	Diode	1SS176	
D104	A7160570	Diode	1SS176	
D105	A7160570	Diode	1SS176	
D107	A7160570	Diode	1SS176	
D108	A7151450	Diode	1SS200	
D201	A7160570	Diode	1SS176	
D202	A7109332	Diode.Zener	05Z 3. 3X	
D203	A7160570	Diode	1SS176	
D204	A7110207	Diode.Zener	05Z 8. 2X	
D205	A7160570	Diode	1SS176	
D206	A7152800	Diode	1SS227	
D401	A7160570	Diode	1SS176	
COILS				
L101	23238764	Coil.Peaking	TRF4102AC	
L102	23237970	Coil.Peaking	TRF4271AC	
L103	23237985	Coil.Peaking	TRF4150AC	
L104	23237975	Coil.Peaking	TRF4101AC	
L105	23239849	Coil.Peaking	TRF4109AH	
L106	23239849	Coil.Peaking	TRF4109AH	
L107	23239849	Coil.Peaking	TRF4109AH	
L108	23239849	Coil.Peaking	TRF4109AH	
L109	23237979	Coil.Peaking	TRF4470AC	
L110	23237993	Coil.Peaking	TRF4339AC	
L111	23237991	Coil.Peaking	TRF4479AC	
L112	23237969	Coil.Peaking	TRF4331AC	
L201	23237975	Coil.Peaking	TRF4101AC	
L202	23237980	Coil.Peaking	TRF4390AC	
L203	23237972	Coil.Peaking	TRF4181AC	
L204	23237977	Coil.Peaking	TRF4680AC	
L206	23239849	Coil.Peaking	TRF4109AH	
L207	23261984	Coil.Choke	HC3035	
L208	23237976	Coil.Peaking	TRF4820AC	
L209	23237975	Coil.Peaking	TRF4101AC	
L210	23237979	Coil.Peaking	TRF4470AC	
L301	23237975	Coil.Peaking	TRF4101AC	
L302	23237979	Coil.Peaking	TRF4470AC	
L401	23237975	Coil.Peaking	TRF4101AC	
L402	23237975	Coil.Peaking	TRF4101AC	
L403	23237975	Coil.Peaking	TRF4101AC	
L701	23238723	Coil.Peaking	TRF4682AC	
L702	23238903	Coil.Peaking	TRF4391AC	
CAPACITORS				
C101	24633220	Cap.Electrolytic	22MF	M 16V
C102	24633220	Cap.Electrolytic	22MF	M 16V
C103	24633220	Cap.Electrolytic	22MF	M 16V
C104	24633220	Cap.Electrolytic	22MF	M 16V
C105	24232103	Cap.Ceramic	0. 01MF	Z 50V
C106	24474103	Cap.Ceramic	0. 01MF	N 50V
C107	24232103	Cap.Ceramic	0. 01MF	Z 50V
C108	24633100	Cap.Electrolytic	10MF	M 16V
C110	24636010	Cap.Electrolytic	1MF	M 50V
C112	24633100	Cap.Electrolytic	10MF	M 16V
C114	24636010	Cap.Electrolytic	1MF	M 50V
C115	24474103	Cap.Ceramic	0. 01MF	N 50V
C116	24474103	Cap.Ceramic	0. 01MF	N 50V
C118	24851473	Cap.Ceramic	0. 047MF	K 25V

Note: Part marked # are of chip type and mounted on original PC boards. However, when they are placed for servicing works, use discrete parts listed on the above parts list.

LOCATION NUMBER	PART NUMBER	DESCRIPTION		
C119	24633220	Cap.Electrolytic	22MF	M 16V
C120	24636010	Cap.Electrolytic	1MF	M 50V
C121	24232103	Cap.Ceramic	0. 01MF	Z 50V
C122	24474103	Cap.Ceramic	0. 01MF	N 50V
C123	24633220	Cap.Electrolytic	22MF	M 16V
C124	24636010	Cap.Electrolytic	1MF	M 50V
C125	24636010	Cap.Electrolytic	1MF	M 50V
C126	24232103	Cap.Ceramic	0. 01MF	Z 50V
C127	24474103	Cap.Ceramic	0. 01MF	N 50V
C128	24633220	Cap.Electrolytic	22MF	M 16V
C129	24636010	Cap.Electrolytic	1MF	M 50V
C130	24436151	Cap.Ceramic	150PF	J 50V
C131	24232223	Cap.Ceramic	0. 022MF	Z 50V
C133	24232103	Cap.Ceramic	0. 01MF	Z 50V
C134	24636478	Cap.Electrolytic	0. 47MF	M 50V
C135	24436241	Cap.Ceramic	240PF	J 50V
C136	24436820	Cap.Ceramic	82PF	J 50V
C138	24232103	Cap.Ceramic	0. 01MF	Z 50V
C139	24633220	Cap.Electrolytic	22MF	M 16V
C140	24474103	Cap.Ceramic	0. 01MF	N 50V
C141	24436821	Cap.Ceramic	820PF	J 50V
C142	24436331	Cap.Ceramic	330PF	J 50V
C143	24633220	Cap.Electrolytic	22MF	M 16V
C144	24212222	Cap.Ceramic	2200PF	K 50V
C145	24851103	Cap.Ceramic	0. 01MF	K 25V
C146	24212102	Cap.Ceramic	1000PF	K 50V
C147	24212222	Cap.Ceramic	2200PF	K 50V
C148	24851103	Cap.Ceramic	0. 01MF	K 25V
C149	24212102	Cap.Ceramic	1000PF	K 50V
C161	24632470	Cap.Electrolytic	47MF	M 10V
C162	24633100	Cap.Electrolytic	10MF	M 16V
C163	24232103	Cap.Ceramic	0. 01MF	Z 50V
C164	24232223	Cap.Ceramic	0. 022MF	Z 50V
C165	24232103	Cap.Ceramic	0. 01MF	Z 50V
C170	24636010	Cap.Electrolytic	1MF	M 50V
C171	24636010	Cap.Electrolytic	1MF	M 50V
C172	24436390	Cap.Ceramic	39PF	J 50V
C173	24232103	Cap.Ceramic	0. 01MF	Z 50V
C174	24212102	Cap.Ceramic	1000PF	K 50V
C175	24794470	Cap.Electrolytic	47MF	M 16V
C176	24232223	Cap.Ceramic	0. 022MF	Z 50V
C177	24232103	Cap.Ceramic	0. 01MF	Z 50V
C178	24436181	Cap.Ceramic	180PF	J 50V
C179	24212102	Cap.Ceramic	1000PF	K 50V
C180	24851103	Cap.Ceramic	0. 01MF	K 25V
C181	24851104	Cap.Ceramic	0. 1MF	K 25V
C201	24633100	Cap.Electrolytic	10MF	M 16V
C202	24633100	Cap.Electrolytic	10MF	M 16V
C203	24436561	Cap.Ceramic	560PF	J 50V
C204	24232103	Cap.Ceramic	0. 01MF	Z 50V
C205	24633220	Cap.Electrolytic	22MF	M 16V
C206	24436121	Cap.Ceramic	120PF	J 50V
C207	24473330	Cap.Ceramic	33PF	J 50V
C208	24436680	Cap.Ceramic	68PF	J 50V
C209	24636010	Cap.Electrolytic	1MF	M 50V
C210	24436101	Cap.Ceramic	100PF	J 50V
C211	24635479	Cap.Electrolytic	4. 7MF	M 35V
C212	24636229	Cap.Electrolytic	2. 2MF	M 50V
C213	24212122	Cap.Ceramic	1200PF	K 50V
C214	24473390	Cap.Ceramic	39PF	J 50V
C215	24436220	Cap.Ceramic	22PF	J 50V
C216	24353470	Cap.Ceramic	47PF	J 50V
C217	24232103	Cap.Ceramic	0. 01MF	Z 50V
C218	24232103	Cap.Ceramic	0. 01MF	Z 50V
C219	24232103	Cap.Ceramic	0. 01MF	Z 50V
C220	24212222	Cap.Ceramic	2200PF	K 50V
C221	24591222	Cap.Plastic	2200PF	J 50V
C222	24232103	Cap.Ceramic	0. 01MF	Z 50V
C223	24474103	Cap.Ceramic	0. 01MF	N 50V
C224	24633220	Cap.Electrolytic	22MF	M 16V
C225	24353390	Cap.Ceramic	39PF	J 50V
C226	24232103	Cap.Ceramic	0. 01MF	Z 50V
C227	24436121	Cap.Ceramic	120PF	J 50V
C228	24851333	Cap.Ceramic	0. 033MF	K 25V
C229	24636229	Cap.Electrolytic	2. 2MF	M 50V

LOCATION NUMBER	PART NUMBER	DESCRIPTION		
C230	24632470	Cap.Electrolytic	47MF	M 10V
C231	24436121	Cap.Ceramic	120PF	J 50V
C232	24232103	Cap.Ceramic	0. 01MF	Z 50V
C233	24636010	Cap.Electrolytic	1MF	M 50V
C234	24436471	Cap.Ceramic	470PF	J 50V
C235	24436271	Cap.Ceramic	270PF	J 50V
C236	24474103	Cap.Ceramic	0. 01MF	N 50V
C237	24591333	Cap.Plastic	0. 033MF	J 50V
C238	24436221	Cap.Ceramic	220PF	J 50V
C239	24636010	Cap.Electrolytic	1MF	M 50V
C240	24436181	Cap.Ceramic	180PF	J 50V
C241	24436821	Cap.Ceramic	820PF	J 50V
C243	24633100	Cap.Electrolytic	10MF	M 16V
C245	24633220	Cap.Electrolytic	22MF	M 16V
C246	24636010	Cap.Electrolytic	1MF	M 50V
C247	24636010	Cap.Electrolytic	1MF	M 50V
C248	24232103	Cap.Ceramic	0. 01MF	Z 50V
C249	24232103	Cap.Ceramic	0. 01MF	Z 50V
C261	24232103	Cap.Ceramic	0. 01MF	Z 50V
C262	24794470	Cap.Electrolytic	47MF	M 16V
C263	24232103	Cap.Ceramic	0. 01MF	Z 50V
C264	24794470	Cap.Electrolytic	47MF	M 16V
C265	24232103	Cap.Ceramic	0. 01MF	Z 50V
C266	24636339	Cap.Electrolytic	3. 3MF	M 50V
C267	24635479	Cap.Electrolytic	4. 7MF	M 35V
C268	24232103	Cap.Ceramic	0. 01MF	Z 50V
C269	24436221	Cap.Ceramic	220PF	J 50V
C270	24538474	Cap.Plastic	0. 47MF	J 50V
C271	24636010	Cap.Electrolytic	1MF	M 50V
C272	24632470	Cap.Electrolytic	47MF	M 10V
C273	24232223	Cap.Ceramic	0. 022MF	Z 50V
C274	24212472	Cap.Ceramic	4700PF	K 50V
C275	24632470	Cap.Electrolytic	47MF	M 10V
C276	24436240	Cap.Ceramic	24PF	J 50V
C277	24633100	Cap.Electrolytic	10MF	M 16V
C278	24436151	Cap.Ceramic	150PF	J 50V
C279	24633220	Cap.Electrolytic	22MF	M 16V
C280	24232103	Cap.Ceramic	0. 01MF	Z 50V
C301	24633220	Cap.Electrolytic	22MF	M 16V
C303	24636010	Cap.Electrolytic	1MF	M 50V
C304	24633220	Cap.Electrolytic	22MF	M 16V
C305	24633220	Cap.Electrolytic	22MF	M 16V
C306	24633220	Cap.Electrolytic	22MF	M 16V
C307	24636010	Cap.Electrolytic	1MF	M 50V
C308	24232103	Cap.Ceramic	0. 01MF	Z 50V
C309	24794470	Cap.Electrolytic	47MF	M 16V
C310	24794471	Cap.Electrolytic	470MF	M 16V
C311	24436181	Cap.Ceramic	180PF	J 50V
C312	24436360	Cap.Ceramic	36PF	J 50V
C314	24474103	Cap.Ceramic	0. 01MF	N 50V
C402	24474103	Cap.Ceramic	0. 01MF	N 50V
C403	24636010	Cap.Electrolytic	1MF	M 50V
C404	24636229	Cap.Electrolytic	2. 2MF	M 50V
C405	24633100	Cap.Electrolytic	10MF	M 16V
C406	24538224	Cap.Plastic	0. 22MF	J 50V
C408	24474103	Cap.Ceramic	0. 01MF	N 50V
C409	24212102	Cap.Ceramic	1000PF	K 50V
C410	24636010	Cap.Electrolytic	1MF	M 50V
C411	24632470	Cap.Electrolytic	47MF	M 10V
C412	24851102	Cap.Ceramic	1000PF	K 25V
C413	24353080	Cap.Ceramic	8PF	J 50V
C414	24353080	Cap.Ceramic	8PF	J 50V
C415	24212472	Cap.Ceramic	4700PF	K 50V
C416	24436680	Cap.Ceramic	68PF	J 50V
C417	24212102	Cap.Ceramic	1000PF	K 50V
C418	24632470	Cap.Electrolytic	47MF	M 10V
C419	24232223	Cap.Ceramic	0. 022MF	Z 50V
C420	24212102	Cap.Ceramic	1000PF	K 50V
C421	24232103	Cap.Ceramic	0. 01MF	Z 50V
C422	24232103	Cap.Ceramic	0. 01MF	Z 50V
C423	24474103	Cap.Ceramic	0. 01MF	N 50V
C424	24538104	Cap.Plastic	0. 1MF	J 50V
C425	24474103	Cap.Ceramic	0. 01MF	N 50V
C428	24591222	Cap.Plastic	2200PF	J 50V
C429	24851104	Cap.Ceramic	0. 1MF	K 25V

LOCATION NUMBER	PART NUMBER	DESCRIPTION		
C432	24436391	Cap.Ceramic	390PF	J 50V
C433	24232103	Cap.Ceramic	0. 01MF	Z 50V
C434	24794470	Cap.Electrolytic	47MF	M 16V
C435	24436100	Cap.Ceramic	10PF	J 50V
C436	24633220	Cap.Electrolytic	22MF	M 16V
C437	24474103	Cap.Ceramic	0. 01MF	N 50V
C438	24232103	Cap.Ceramic	0. 01MF	Z 50V
C439	24474103	Cap.Ceramic	0. 01MF	N 50V
C440	24436820	Cap.Ceramic	82PF	J 50V
C441	24851473	Cap.Ceramic	0. 047MF	K 25V
C451	24093983	Cap.Variable	2. 7PF	
C701	24636479	Cap.Electrolytic	4. 7MF	M 50V
C702	24212821	Cap.Ceramic	820PF	K 50V
C703	24212222	Cap.Ceramic	2200PF	K 50V
C704	24591472	Cap.Plastic	4700PF	J 50V
C705	24591103	Cap.Plastic	0. 01MF	J 50V
C706	24636479	Cap.Electrolytic	4. 7MF	M 50V
C707	24794470	Cap.Electrolytic	47MF	M 16V
C708	24633100	Cap.Electrolytic	10MF	M 16V
C709	24794470	Cap.Electrolytic	47MF	M 16V
C711	24794470	Cap.Electrolytic	47MF	M 16V
C712	24636479	Cap.Electrolytic	4. 7MF	M 50V
C713	24591223	Cap.Plastic	0. 022MF	J 50V
C714	24591563	Cap.Plastic	0. 053MF	J 50V
C715	24636479	Cap.Electrolytic	4. 7MF	M 50V
C717	24794470	Cap.Electrolytic	47MF	M 16V
C718	24794470	Cap.Electrolytic	47MF	M 16V
C719	24794470	Cap.Electrolytic	47MF	M 16V
C720	24212472	Cap.Ceramic	4700PF	K 50V
C721	24212682	Cap.Ceramic	6800PF	K 50V
C722	24538823	Cap.Plastic	0. 082MF	J 50V
C723	24214221	Cap.Ceramic	220PF	K 500V
C724	24591223	Cap.Plastic	0. 022MF	J 50V
C791	24212821	Cap.Ceramic	820PF	K 50V
C792	24633100	Cap.Electrolytic	10MF	M 16V
RESISTORS				
R101	24366821	Res.Carbon	820	J 1/6W
R102	24366152	Res.Carbon	1. 5K	J 1/6W
R103	24366473	Res.Carbon	47K	J 1/6W
R104	24366472	Res.Carbon	4. 7K	J 1/6W
R105	24366223	Res.Carbon	22K	J 1/6W
R106	24366473	Res.Carbon	47K	J 1/6W
R107	24366131	Res.Carbon	130	J 1/6W
R108	24366222	Res.Carbon	2. 2K	J 1/6W
R109	24366331	Res.Carbon	330	J 1/6W
R110	24366242	Res.Carbon	2. 4K	J 1/6W
R111	24366152	Res.Carbon	1. 5K	J 1/6W
R112	24366152	Res.Carbon	1. 5K	J 1/6W
R113	24366222	Res.Carbon	2. 2K	J 1/6W
R114	24366222	Res.Carbon	2. 2K	J 1/6W
R115	24366242	Res.Carbon	2. 4K	J 1/6W
R116	24366102	Res.Carbon	1K	J 1/6W
R117	24366471	Res.Carbon	470	J 1/6W
R118	24366223	Res.Carbon	22K	J 1/6W
R120	24366332	Res.Carbon	3. 3K	J 1/6W
R121	24366131	Res.Carbon	130	J 1/6W
R122	24366271	Res.Carbon	270	J 1/6W
R123	24366102	Res.Carbon	1K	J 1/6W
R124	24366473	Res.Carbon	47K	J 1/6W
R125	24366242	Res.Carbon	2. 4K	J 1/6W
R126	24366272	Res.Carbon	2. 7K	J 1/6W
R127	24366152	Res.Carbon	1. 5K	J 1/6W
R128	24366152	Res.Carbon	1. 5K	J 1/6W
R129	24366301	Res.Carbon	300	J 1/6W
R130	24366242	Res.Carbon	2. 4K	J 1/6W
R131	24366272	Res.Carbon	2. 7K	J 1/6W
R132	24366333	Res.Carbon	33K	J 1/6W
R133	24366333	Res.Carbon	33K	J 1/6W
R134	24366473	Res.Carbon	47K	J 1/6W
R135	24366333	Res.Carbon	33K	J 1/6W
R137	24366332	Res.Carbon	3. 3K	J 1/6W
R139	24366103	Res.Carbon	10K	J 1/6W
R140	24366182	Res.Carbon	1. 8K	J 1/6W
R141	24366102	Res.Carbon	1K	J 1/6W
R142	24366101	Res.Carbon	100	J 1/6W

LOCATION NUMBER	PART NUMBER	DESCRIPTION		
R143	24366103	Res.Carbon	10K	J 1/6W
R144	24366102	Res.Carbon	1K	J 1/6W
R145	24366331	Res.Carbon	330	J 1/6W
R146	24366122	Res.Carbon	1. 2K	J 1/6W
R147	24366472	Res.Carbon	4. 7K	J 1/6W
R148	24366222	Res.Carbon	2. 2K	J 1/6W
R149	24366332	Res.Carbon	3. 3K	J 1/6W
R162	24366472	Res.Carbon	4. 7K	J 1/6W
R163	24366222	Res.Carbon	2. 2K	J 1/6W
R164	24366332	Res.Carbon	3. 3K	J 1/6W
R167	24366182	Res.Carbon	1. 8K	J 1/6W
R168	24366332	Res.Carbon	3. 3K	J 1/6W
R170	24366103	Res.Carbon	10K	J 1/6W
R171	24366223	Res.Carbon	22K	J 1/6W
R172	24366103	Res.Carbon	10K	J 1/6W
R173	24366101	Res.Carbon	100	J 1/6W
R174	24366101	Res.Carbon	100	J 1/6W
R175	24366821	Res.Carbon	820	J 1/6W
R176	24366821	Res.Carbon	820	J 1/6W
R177	24366821	Res.Carbon	820	J 1/6W
R178	24366821	Res.Carbon	820	J 1/6W
R181	24366222	Res.Carbon	2. 2K	J 1/6W
R182	24366122	Res.Carbon	1. 2K	J 1/6W
R183	24366122	Res.Carbon	1. 2K	J 1/6W
R184	24366102	Res.Carbon	1K	J 1/6W
R185	24366102	Res.Carbon	1K	J 1/6W
R186	24366222	Res.Carbon	2. 2K	J 1/6W
R187	24366182	Res.Carbon	1. 8K	J 1/6W
R188	24366684	Res.Carbon	680K	J 1/6W
R189	24366473	Res.Carbon	47K	J 1/6W
R190	24366473	Res.Carbon	47K	J 1/6W
R191	24366473	Res.Carbon	47K	J 1/6W
R192	24366223	Res.Carbon	22K	J 1/6W
R193	24366471	Res.Carbon	470	J 1/6W
R194	24366471	Res.Carbon	470	J 1/6W
R195	24366102	Res.Carbon	1K	J 1/6W
R196	24366222	Res.Carbon	2. 2K	J 1/6W
R197	24366222	Res.Carbon	2. 2K	J 1/6W
R201	24366122	Res.Carbon	1. 2K	J 1/6W
R202	24366472	Res.Carbon	4. 7K	J 1/6W
R203	24366821	Res.Carbon	820	J 1/6W
R204	24366564	Res.Carbon	560K	J 1/6W
R205	24366223	Res.Carbon	22K	J 1/6W
R206	24366182	Res.Carbon	1. 8K	J 1/6W
R207	24366681	Res.Carbon	680	J 1/6W
R208	24366182	Res.Carbon	1. 8K	J 1/6W
R209	24366122	Res.Carbon	1. 2K	J 1/6W
R210	24366392	Res.Carbon	3. 9K	J 1/6W
R211	24366222	Res.Carbon	2. 2K	J 1/6W
R212	24366182	Res.Carbon	1. 8K	J 1/6W
R213	24366103	Res.Carbon	10K	J 1/6W
R214	24366222	Res.Carbon	2. 2K	J 1/6W
R215	24366100	Res.Carbon	10	J 1/6W
R216	24366564	Res.Carbon	560K	J 1/6W
R217	24366331	Res.Carbon	330	J 1/6W
R218	24366105	Res.Carbon	1M	J 1/6W
R219	24366123	Res.Carbon	12K	J 1/6W
R220	24366822	Res.Carbon	8. 2K	J 1/6W
R221	24366563	Res.Carbon	56K	J 1/6W
R222	24366102	Res.Carbon	1K	J 1/6W
R223	24366123	Res.Carbon	12K	J 1/6W
R224	24366682	Res.Carbon	6. 8K	J 1/6W
R225	24366202	Res.Carbon	2K	J 1/6W
R226	24366821	Res.Carbon	820	J 1/6W
R227	24366222	Res.Carbon	2. 2K	J 1/6W
R228	24366512	Res.Carbon	5. 1K	J 1/6W
R229	24366562	Res.Carbon	5. 6K	J 1/6W
R230	24366821	Res.Carbon	820	J 1/6W
R231	24366392	Res.Carbon	3. 9K	J 1/6W
R232	24366103	Res.Carbon	10K	J 1/6W
R233	24366102	Res.Carbon	1K	J 1/6W
R234	24366222	Res.Carbon	2. 2K	J 1/6W
R235	24366123	Res.Carbon	12K	J 1/6W
R236	24366104	Res.Carbon	100K	J 1/6W
R237	24366681	Res.Carbon	680	J 1/6W

LOCATION NUMBER	PART NUMBER	DESCRIPTION		
R238	24366473	Res.Carbon	47K	J 1/6W
R239	24366123	Res.Carbon	12K	J 1/6W
R240	24366682	Res.Carbon	6. 8K	J 1/6W
R241	24366333	Res.Carbon	33K	J 1/6W
R242	24366333	Res.Carbon	33K	J 1/6W
R243	24366272	Res.Carbon	2. 7K	J 1/6W
R244	24366562	Res.Carbon	5. 6K	J 1/6W
R245	24366562	Res.Carbon	5. 6K	J 1/6W
R246	24366102	Res.Carbon	1K	J 1/6W
R247	24366102	Res.Carbon	1K	J 1/6W
R248	24366122	Res.Carbon	1. 2K	J 1/6W
R249	24366271	Res.Carbon	270	J 1/6W
R251	24066954	Res.Variable	2K	
R252	24066952	Res.Variable	10K	
R253	24066952	Res.Variable	10K	
R254	24066953	Res.Variable	100K	
R255	24066953	Res.Variable	100K	
R256	24066952	Res.Variable	10K	
R257	24066955	Res.Variable	1K	
R261	24366182	Res.Carbon	1. 8K	J 1/6W
R262	24366122	Res.Carbon	1. 2K	J 1/6W
R263	24366331	Res.Carbon	330	J 1/6W
R264	24366102	Res.Carbon	1K	J 1/6W
R265	24366121	Res.Carbon	120	J 1/6W
R266	24366131	Res.Carbon	130	J 1/6W
R267	24366181	Res.Carbon	180	J 1/6W
R268	24366121	Res.Carbon	120	J 1/6W
R269	24366102	Res.Carbon	1K	J 1/6W
R270	24366272	Res.Carbon	2. 7K	J 1/6W
R271	24366105	Res.Carbon	1M	J 1/6W
R272	24366105	Res.Carbon	1M	J 1/6W
R273	24366102	Res.Carbon	1K	J 1/6W
R276	24366911	Res.Carbon	910	G 1/6W
R277	24000952	Res.Thermistor	3K	K
R278	24366331	Res.Carbon	330	J 1/6W
R279	24366561	Res.Carbon	560	J 1/6W
R280	24366161	Res.Carbon	160	J 1/6W
R281	24366272	Res.Carbon	2. 7K	J 1/6W
R282	24366274	Res.Carbon	270K	J 1/6W
R284	24366273	Res.Carbon	27K	J 1/6W
R285	24366152	Res.Carbon	1. 5K	J 1/6W
R286	24366332	Res.Carbon	3. 3K	J 1/6W
R287	24366332	Res.Carbon	3. 3K	J 1/6W
R288	24366103	Res.Carbon	10K	J 1/6W
R289	24366202	Res.Carbon	2K	J 1/6W
R290	24366222	Res.Carbon	2. 2K	J 1/6W
R291	24366103	Res.Carbon	10K	J 1/6W
R292	24366333	Res.Carbon	33K	J 1/6W
R293	24366103	Res.Carbon	10K	J 1/6W
R294	24366102	Res.Carbon	1K	J 1/6W
R295	24366393	Res.Carbon	39K	J 1/6W
R296	24366104	Res.Carbon	100K	J 1/6W
R297	24366473	Res.Carbon	47K	J 1/6W
R298	24366682	Res.Carbon	6. 8K	J 1/6W
R301	24366473	Res.Carbon	47K	J 1/6W
R302	24366473	Res.Carbon	47K	J 1/6W
R303	24366102	Res.Carbon	1K	J 1/6W
R304	24366223	Res.Carbon	22K	J 1/6W
R305	24366104	Res.Carbon	100K	J 1/6W
R306	24366104	Res.Carbon	100K	J 1/6W
R307	24366223	Res.Carbon	22K	J 1/6W
R308	24366750	Res.Carbon	75	J 1/6W
R310	24366750	Res.Carbon	75	J 1/6W
R311	24366122	Res.Carbon	1. 2K	J 1/6W
R312	24366822	Res.Carbon	8. 2K	J 1/6W
R313	24366222	Res.Carbon	2. 2K	J 1/6W
R314	24366102	Res.Carbon	1K	J 1/6W
R315	24366102	Res.Carbon	1K	J 1/6W
R316	24366102	Res.Carbon	1K	J 1/6W
R317	24366471	Res.Carbon	470	J 1/6W
R318	24376561	Res.Carbon	560	J 1/2W
R319	24366101	Res.Carbon	100	J 1/6W
R320	24366152	Res.Carbon	1. 5K	J 1/6W
R321	24366471	Res.Carbon	470	J 1/6W
R397	24360273	Res.Carbon	27K	J 1/8W

LOCATION NUMBER	PART NUMBER	DESCRIPTION		
R398	24360472	Res.Carbon	4. 7K	J 1/8W
R399	24360183	Res.Carbon	18K	J 1/8W
R402	24366472	Res.Carbon	4. 7K	J 1/6W
R404	24366822	Res.Carbon	8. 2K	J 1/6W
R405	24366473	Res.Carbon	47K	J 1/6W
R406	24366223	Res.Carbon	22K	J 1/6W
R407	24366153	Res.Carbon	15K	J 1/6W
R408	24366273	Res.Carbon	27K	J 1/6W
R409	24366681	Res.Carbon	680	J 1/6W
R410	24366562	Res.Carbon	5. 6K	J 1/6W
R411	24366333	Res.Carbon	33K	J 1/6W
R412	24366272	Res.Carbon	2. 7K	J 1/6W
R413	24366472	Res.Carbon	4. 7K	J 1/6W
R414	24366222	Res.Carbon	2. 2K	J 1/6W
R415	24366473	Res.Carbon	47K	J 1/6W
R416	24366102	Res.Carbon	1K	J 1/6W
R417	24366122	Res.Carbon	1. 2K	J 1/6W
R418	24366183	Res.Carbon	18K	J 1/6W
R419	24366223	Res.Carbon	22K	J 1/6W
R420	24366102	Res.Carbon	1K	J 1/6W
R421	24366431	Res.Carbon	430	J 1/6W
R422	24366471	Res.Carbon	470	J 1/6W
R423	24366561	Res.Carbon	560	J 1/6W
R424	24366333	Res.Carbon	33K	J 1/6W
R425	24366822	Res.Carbon	8. 2K	J 1/6W
R426	24366271	Res.Carbon	270	J 1/6W
R427	24366202	Res.Carbon	2K	J 1/6W
R428	24366561	Res.Carbon	560	J 1/6W
R430	24366102	Res.Carbon	1K	J 1/6W
R431	24366102	Res.Carbon	1K	J 1/6W
R432	24366822	Res.Carbon	8. 2K	J 1/6W
R433	24366102	Res.Carbon	1K	J 1/6W
R435	24366103	Res.Carbon	10K	J 1/6W
R436	24366102	Res.Carbon	1K	J 1/6W
R437	24366331	Res.Carbon	330	J 1/6W
R438	24366151	Res.Carbon	150	J 1/6W
R439	24366331	Res.Carbon	330	J 1/6W
R440	24366153	Res.Carbon	15K	J 1/6W
R441	24366472	Res.Carbon	4. 7K	J 1/6W
R442	24366222	Res.Carbon	2. 2K	J 1/6W
R443	24366122	Res.Carbon	1. 2K	J 1/6W
R444	24366471	Res.Carbon	470	J 1/6W
R445	24366222	Res.Carbon	2. 2K	J 1/6W
R446	24366152	Res.Carbon	1. 5K	J 1/6W
R447	24366272	Res.Carbon	2. 7K	J 1/6W
R448	24366151	Res.Carbon	150	J 1/6W
R449	24366332	Res.Carbon	3. 3K	J 1/6W
R451	24066953	Res.Variable	100K	
R452	24066956	Res.Variable	500	
R453	24066950	Res.Variable	50k	
R702	24366103	Res.Carbon	10K	J 1/6W
R703	24366272	Res.Carbon	2. 7K	J 1/6W
R704	24366331	Res.Carbon	330	J 1/6W
R705	24366204	Res.Carbon	200K	J 1/6W
R706	24366161	Res.Carbon	160	J 1/6W
R707	24366123	Res.Carbon	12K	J 1/6W
R709	24366472	Res.Carbon	4. 7K	J 1/6W
R710	24366272	Res.Carbon	2. 7K	J 1/6W
R711	24366103	Res.Carbon	10K	J 1/6W
R712	24366272	Res.Carbon	2. 7K	J 1/6W
R713	24366242	Res.Carbon	2. 4K	J 1/6W
R714	24366105	Res.Carbon	1M	J 1/6W
R715	24366680	Res.Carbon	68	J 1/6W
R716	24366243	Res.Carbon	24K	J 1/6W
R717	24366473	Res.Carbon	47K	J 1/6W
R718	24366103	Res.Carbon	10K	J 1/6W
R719	24366103	Res.Carbon	10K	J 1/6W
R720	24366153	Res.Carbon	15K	J 1/6W
R721	24366101	Res.Carbon	100	J 1/6W
R722	24366229	Res.Carbon	2. 2	J 1/6W
R723	24366243	Res.Carbon	24K	J 1/6W
R725	24366563	Res.Carbon	56K	J 1/6W
R726	24366302	Res.Carbon	3K	J 1/6W
⚠R727	70420013	Res.Fusible	4. 7	J
R751	24066982	Res.Variable	10k	

LOCATION NUMBER	PART NUMBER	DESCRIPTION		
R752	24066978	Res.Variable	200k	
R791	24366104	Res.Carbon	100K	J 1/6W
R792	24366103	Res.Carbon	10K	J 1/6W
R793	24366202	Res.Carbon	2K	J 1/6W
R794	24366104	Res.Carbon	100K	J 1/6W
MISCELLANEOUS				
P201	23363526	Phono Jack		
P202	23363252	Phono Jack		
P704	23363254	Phono Jack		
P705	23363253	Phono Jack		
T701	23225695	Coil.TLN1038.65KHz		
X401	23153961	Crystal, 3. 58MHz		
X402	70138059	1H Delay		
Z201	23107885	Filter.TLC1029.3. 7MHz		
Z202	70132212	Filter.BF-050, 2. 7MHz		
Z401	23107807	Filter.TLC1062,3. 58MHz		
Z403	23107952	Filter.Ceramic, 10. 7MHz		
SERVO.LOGIC.SELECTOR BOARD				
U501	70194681	P C Board Assy.Servo, Logic		
INTEGRATED CIRCUITS				
IC501	B0272600	IC	TD6360P	
IC502	B0475382	IC	TC4538BP	
IC503	B0470303	IC	TC4030BP	
IC504	B0470303	IC	TC4030BP	
IC505	B0470662	IC	TC4066BP	
IC506	B0475382	IC	TC4538BP	
IC507	B0351500	IC	TA75902P	
IC508	B0351500	IC	TA75902P	
IC509	B0470016	IC	TC4001BP	
IC601	70119514	IC	TMP47465760	
IC602	B0320635	IC	TA7288P	
IC603	B0320440	IC	TA7267P	
IC604	B0347230	IC	TA75339P	
ICA01	70119516	IC	M50430081SP	
ICA02	70119517	IC	M58659P	
TRANSISTORS				
Q521	A6012040	Transistor	RN2204	
Q522	A6332430	Transistor	2SC2458-Y	
Q523	A6002040	Transistor	RN1204	
Q524	A6012040	Transistor	RN2204	
Q525	A6332430	Transistor	2SC2458-Y	
Q526	A6534430	Transistor	2SA1048-Y	
Q528	A6332430	Transistor	2SC2458-Y	
Q529	A6844100	Transistor	2SD686	
Q531	A6332430	Transistor	2SC2458-Y	
Q532	A6841900	Transistor	2SD549	
Q533	A6534430	Transistor	2SA1048-Y	
Q535	A6048350	Transistor,FET	2SK30ATM	
Q536	A6533240	Transistor	2SA966-Y	
Q537	A6002040	Transistor	RN1204	
Q611	A6332430	Transistor	2SC2458-Y	
Q612	A6332430	Transistor	2SC2458-Y	
Q613	A6332430	Transistor	2SC2458-Y	
Q614	A6534430	Transistor	2SA1048-Y	
Q615	A6534430	Transistor	2SA1048-Y	
Q616	A6533240	Transistor	2SA966-Y	
Q617	A6533240	Transistor	2SA966-Y	
Q618	A6002060	Transistor	RN1206	
Q619	A6002060	Transistor	RN1206	
Q620	A6325540	Transistor	SC2236-Y	
Q621	A6332430	Transistor	2SC2458-Y	
Q623	A6332430	Transistor	2SC2458-Y	
Q625	A6633620	Transistor	2SB834-Y	
Q626	A6332430	Transistor	2SC2458-Y	
Q627	A6332430	Transistor	2SC2458-Y	
Q629	A6002030	Transistor	RN1203	
Q630	A6332430	Transistor	2SC2458-Y	
Q631	A6332430	Transistor	2SC2458-Y	
Q632	A6332430	Transistor	2SC2458-Y	
Q641	A6002040	Transistor	RN1204	
Q642	A6332430	Transistor	2SC2458-Y	
Q860	A6332430	Transistor	2SC2458-Y	
QA03	A6332430	Transistor	2SC2458-Y	
QA04	A6012020	Transistor	RN2202	

LOCATION NUMBER	PART NUMBER	DESCRIPTION		
QA05	A6332430	Transistor	2SC2458-Y	
QA06	A6002040	Transistor	RN1204	
DIODES				
D503	A7160570	Diode	1SS176	
D504	A7160570	Diode	1SS176	
D505	A7160570	Diode	1SS176	
D506	A7152800	Diode	1SS227	
D507	A7152800	Diode	1SS227	
D508	A7151500	Diode	1SS201	
D509	A7246711	Diode	1S1555(TV)	
D511	A7246711	Diode	1S1555(TV)	
D512	A7151500	Diode	1SS201	
D513	A7152800	Diode	1SS227	
D514	A7160570	Diode	1SS176	
D515	A7160570	Diode	1SS176	
D516	A7160570	Diode	1SS176	
D517	A7160570	Diode	1SS176	
D518	A7160570	Diode	1SS176	
D519	A7160570	Diode	1SS176	
D520	A7160570	Diode	1SS176	
D521	A7160570	Diode	1SS176	
D522	A7160570	Diode	1SS176	
D523	A7160570	Diode	1SS176	
D524	A7160570	Diode	1SS176	
D525	A7160570	Diode	1SS176	
D526	A7246711	Diode	1S1555(TV)	
D531	A7152800	Diode	1SS227	
D532	A7160570	Diode	1SS176	
D533	A7160570	Diode	1SS176	
D534	A7160570	Diode	1SS176	
D601	A7109395	Diode,Zener	05Z 3. 9-Y	
D602	A7160570	Diode	1SS176	
D604	A7160570	Diode	1SS176	
D606	A7160570	Diode	1SS176	
D607	A7160570	Diode	1SS176	
D860	A7152800	Diode	1SS227	
D861	A7110115	Diode,Zener	05Z 6. 8Y	
D862	A7110645	Diode.Zener	05Z 22-X	
D863	A7160570	Diode	1SS176	
DA01	23115922	Diode,Zener	UPC574J	
DA02	A8600606	Diode,LED	TLR113AD-FA	
DA04	A7160570	Diode	1SS176	
DA05	A7160570	Diode	1SS176	
COILS				
L601	23237999	Coil.Peaking	TRF4109AC	
L602	23237999	Coil.Peaking	TRF4109AC	
CAPACITORS				
C501	24538184	Cap.Plastic	0.18MF	J 50V
C502	24538154	Cap.Plastic	0. 15MF	J 50V
C503	24636478	Cap.Electrolytic	0. 47MF	M 50V
C504	24633220	Cap.Electrolytic	22MF	M 16V
C505	24591222	Cap.Plastic	2200PF	J 50V
C506	24593362	Cap.Plastic	3600PF	J 50V
C507	24593362	Cap.Plastic	3600PF	J 50V
C508	24591103	Cap.Plastic	0. 01MF	J 50V
C509	24794470	Cap.Electrolytic	47MF	M 16V
C511	24474103	Cap.Ceramic	0. 01MF	N 50V
C512	24232103	Cap.Ceramic	0. 01MF	Z 50V
C513	24212102	Cap.Ceramic	1000PF	K 50V
C514	24794470	Cap.Electrolytic	47MF	M 16V
C516	24212471	Cap.Ceramic	470PF	K 50V
C517	24591823	Cap.Plastic	0. 082MF	J 50V
C518	24538224	Cap.Plastic	0. 22MF	J 50V
C519	24212222	Cap.Ceramic	2200PF	K 50V
C520	24591223	Cap.Plastic	0. 022MF	J 50V
C521	24085987	Cap.Electrolytic	4. 7MF	M 16V
C522	24212102	Cap.Ceramic	1000PF	K 50V
C523	24633100	Cap.Electrolytic	10MF	M 16V
C524	24212561	Cap.Ceramic	560PF	K 50V
C525	24794470	Cap.Electrolytic	47MF	M 16V
C526	24794470	Cap.Electrolytic	47MF	M 16V
C527	24591103	Cap.Plastic	0. 01MF	J 50V
C528	24591103	Cap.Plastic	0. 01MF	J 50V
C529	24633220	Cap.Electrolytic	22MF	M 16V
C530	24591363	Cap.Plastic	0. 036MF	J 50V

LOCATION NUMBER	PART NUMBER	DESCRIPTION		
C531	24598153	Cap.Plastic	0. 015MF	J 50V
C532	24591682	Cap.Plastic	6800PF	J 50V
C533	24212102	Cap.Ceramic	1000PF	K 50V
C534	24436471	Cap.Ceramic	470PF	J 50V
C535	24212102	Cap.Ceramic	1000PF	K 50V
C536	24212102	Cap.Ceramic	1000PF	K 50V
C537	24591102	Cap.Plastic	1000PF	J 50V
C538	24232103	Cap.Ceramic	0. 01MF	Z 50V
C539	24591202	Cap.Plastic	2000PF	J 50V
C540	24591102	Cap.Plastic	1000PF	J 50V
C541	24591472	Cap.Plastic	4700PF	J 50V
C542	24591272	Cap.Plastic	2700PF	J 50V
C543	24591822	Cap.Plastic	8200PF	J 50V
C546	24633220	Cap.Electrolytic	22MF	M 16V
C547	24591223	Cap.Plastic	0. 022MF	J 50V
C548	24212102	Cap.Ceramic	1000PF	K 50V
C550	24474103	Cap.Ceramic	0. 01MF	N 50V
C551	24633220	Cap.Electrolytic	22MF	M 16V
C552	24633220	Cap.Electrolytic	22MF	M 16V
C601	24794470	Cap.Electrolytic	47MF	M 16V
C602	24232103	Cap.Ceramic	0. 01MF	Z 50V
C603	24232103	Cap.Ceramic	0. 01MF	Z 50V
C604	24436101	Cap.Ceramic	100PF	J 50V
C605	24436101	Cap.Ceramic	100PF	J 50V
C607	24793101	Cap.Electrolytic	100MF	M 10V
C608	24794470	Cap.Electrolytic	47MF	M 16V
C609	24636479	Cap.Electrolytic	4. 7MF	M 50V
C610	24794470	Cap.Electrolytic	47MF	M 16V
C611	24633100	Cap.Electrolytic	10MF	M 16V
C612	24232103	Cap.Ceramic	0. 01MF	Z 50V
C613	24232103	Cap.Ceramic	0. 01MF	Z 50V
C614	24232103	Cap.Ceramic	0. 01MF	Z 50V
C615	24232223	Cap.Ceramic	0. 022MF	Z 50V
C616	24232223	Cap.Ceramic	0. 022MF	Z 50V
C618	24794470	Cap.Electrolytic	47MF	M 16V
C620	24232223	Cap.Ceramic	0. 022MF	Z 50V
C621	24232223	Cap.Ceramic	0. 022MF	Z 50V
C622	24232223	Cap.Ceramic	0. 022MF	Z 50V
C623	24591103	Cap.Plastic	0. 01MF	J 50V
C861	24796470	Cap.Electrolytic	47MF	M 35V
C862	24792222	Cap.Electrolytic	2200MF	M 6. 3V
CA01	24436151	Cap.Ceramic	150PF	J 50V
CA02	24538104	Cap.Plastic	0. 1MF	J 50V
CA03	24538104	Cap.Plastic	0. 1MF	J 50V
CA05	24630923	Cap.Electrolytic	100MF	M 50V
CA06	24232103	Cap.Ceramic	0. 01MF	Z 50V
CA07	24436470	Cap.Ceramic	47PF	J 50V
CA08	24436470	Cap.Ceramic	47PF	J 50V
CA09	24794101	Cap.Electrolytic	100MF	M 16V
CA12	24538104	Cap.Plastic	0. 1MF	J 50V
CA13	24203100	Cap.Electrolytic	10MF	M 16V
CA16	24212221	Cap.Ceramic	220PF	K 50V
CA30	24232102	Cap.Ceramic	1000PF	Z 50V
RESISTORS				
R351	24069740	Res.Variable	500	
R501	24366394	Res.Carbon	390K	J 1/6W
R503	24360273	Res.Carbon	27K	J 1/8W
R504	24366243	Res.Carbon	24K	J 1/6W
R505	24366563	Res.Carbon	56K	J 1/6W
R506	24366105	Res.Carbon	1M	J 1/6W
R507	24366333	Res.Carbon	33K	J 1/6W
R508	24366105	Res.Carbon	1M	J 1/6W
R509	24366680	Res.Carbon	68	J 1/6W
R510	24366242	Res.Carbon	2. 4K	J 1/6W
R512	24366303	Res.Carbon	30K	J 1/6W
R513	24366103	Res.Carbon	10K	J 1/6W
R516	24366472	Res.Carbon	4. 7K	J 1/6W
R517	24366105	Res.Carbon	1M	J 1/6W
R518	24376823	Res.Carbon	82K	J 1/2W
R519	24366224	Res.Carbon	220K	J 1/6W
R520	24366334	Res.Carbon	330K	J 1/6W
R521	24366334	Res.Carbon	330K	J 1/6W
R522	24366683	Res.Carbon	68K	J 1/6W
R523	24366562	Res.Carbon	5. 6K	J 1/6W
R524	24360332	Res.Carbon	3. 3K	J 1/6W

LOCATION NUMBER	PART NUMBER	DESCRIPTION		
R525	24366752	Res.Carbon	7. 5K	J 1/6W
R526	24366753	Res.Carbon	75K	J 1/6W
R527	24366123	Res.Carbon	12K	J 1/6W
R528	24366752	Res.Carbon	7. 5K	J 1/6W
R531	24366134	Res.Carbon	130K	J 1/6W
R532	24941275	Res.Solid	2. 7M	J 1/4W
R533	24366105	Res.Carbon	1M	J 1/6W
R534	24366104	Res.Carbon	100K	J 1/6W
R535	24366473	Res.Carbon	47K	J 1/6W
R536	24366103	Res.Carbon	10K	J 1/6W
R537	24366272	Res.Carbon	2. 7K	J 1/6W
R538	24366103	Res.Carbon	10K	J 1/6W
R539	24366105	Res.Carbon	1M	J 1/6W
R540	24366621	Res.Carbon	620	J 1/6W
R541	24366563	Res.Carbon	56K	J 1/6W
R542	24366364	Res.Carbon	360K	J 1/6W
R543	24366621	Res.Carbon	620	J 1/6W
R544	24366472	Res.Carbon	4. 7K	J 1/6W
R545	24366392	Res.Carbon	3. 9K	J 1/6W
R546	24366224	Res.Carbon	220K	J 1/6W
R547	24366222	Res.Carbon	2. 2K	J 1/6W
R548	24366221	Res.Carbon	220	J 1/6W
R549	24366912	Res.Carbon	9. 1K	J 1/6W
R551	24066871	Res.Variable	500K	
R552	24066871	Res.Variable	500K	
R553	24066924	Res.Variable	50K	
R557	24066922	Res.Variable	200K	
R560	24366752	Res.Carbon	7. 5K	J 1/6W
R561	24366473	Res.Carbon	47K	J 1/6W
R562	24366102	Res.Carbon	1K	J 1/6W
R563	24366473	Res.Carbon	47K	J 1/6W
R564	24360104	Res.Carbon	100K	J 1/8W
R565	24366472	Res.Carbon	4. 7K	J 1/6W
R566	24366472	Res.Carbon	4. 7K	J 1/6W
R567	24366224	Res.Carbon	220K	J 1/6W
R568	24366154	Res.Carbon	150K	J 1/6W
R569	24366203	Res.Carbon	20K	J 1/6W
R570	24366623	Res.Carbon	62K	J 1/6W
R571	24366683	Res.Carbon	68K	J 1/6W
R573	24366104	Res.Carbon	100K	J 1/6W
R574	24366104	Res.Carbon	100K	J 1/6W
R575	24366184	Res.Carbon	180K	J 1/6W
R576	24366204	Res.Carbon	200K	J 1/6W
R577	24366184	Res.Carbon	180K	J 1/6W
R578	24366244	Res.Carbon	240K	J 1/6W
R579	24366332	Res.Carbon	3. 3K	J 1/6W
R580	24366332	Res.Carbon	3. 3K	J 1/6W
R581	24366222	Res.Carbon	2. 2K	J 1/6W
R582	24366472	Res.Carbon	4. 7K	J 1/6W
R584	24366204	Res.Carbon	200K	J 1/6W
R585	24366104	Res.Carbon	100K	J 1/6W
R588	24366512	Res.Carbon	5. 1K	J 1/6W
R589	24366123	Res.Carbon	12K	J 1/6W
R590	24366153	Res.Carbon	15K	J 1/6W
R591	24366683	Res.Carbon	68K	J 1/6W
R592	24366334	Res.Carbon	330K	J 1/6W
R593	24366134	Res.Carbon	130K	J 1/6W
R597	24366272	Res.Carbon	2. 7K	J 1/6W
R598	24366113	Res.Carbon	11K	J 1/6W
R599	24366183	Res.Carbon	18K	J 1/6W
R601	24366161	Res.Carbon	160	J 1/6W
R602	24366102	Res.Carbon	1K	J 1/6W
R603	24366472	Res.Carbon	4. 7K	J 1/6W
R604	24366473	Res.Carbon	47K	J 1/6W
R605	24366473	Res.Carbon	47K	J 1/6W
R606	24366472	Res.Carbon	4. 7K	J 1/6W
R607	24366223	Res.Carbon	22K	J 1/6W
R609	24366102	Res.Carbon	1K	J 1/6W
R610	24366332	Res.Carbon	3. 3K	J 1/6W
R611	24366103	Res.Carbon	10K	J 1/6W
R612	24366103	Res.Carbon	10K	J 1/6W
R613	24366103	Res.Carbon	10K	J 1/6W
R614	24366103	Res.Carbon	10K	J 1/6W
R615	24366103	Res.Carbon	10K	J 1/6W
R616	24366103	Res.Carbon	10K	J 1/6W

LOCATION NUMBER	PART NUMBER	DESCRIPTION		
R617	24366103	Res.Carbon	10K	J 1/6W
R618	24366822	Res.Carbon	8. 2K	J 1/6W
R619	24366822	Res.Carbon	8. 2K	J 1/6W
R620	24366103	Res.Carbon	10K	J 1/6W
R621	24366223	Res.Carbon	22K	J 1/6W
R622	24366223	Res.Carbon	22K	J 1/6W
R623	24366223	Res.Carbon	22K	J 1/6W
R624	24366472	Res.Carbon	4. 7K	J 1/6W
R625	24366472	Res.Carbon	4. 7K	J 1/6W
R626	24366124	Res.Carbon	120K	J 1/6W
R627	24366124	Res.Carbon	120K	J 1/6W
R629	24366472	Res.Carbon	4. 7K	J 1/6W
R630	24366151	Res.Carbon	150	J 1/6W
R631	24366103	Res.Carbon	10K	J 1/6W
R632	24366472	Res.Carbon	4. 7K	J 1/6W
R633	24366103	Res.Carbon	10K	J 1/6W
R634	24366103	Res.Carbon	10K	J 1/6W
R635	24366103	Res.Carbon	10K	J 1/6W
R636	24366472	Res.Carbon	4. 7K	J 1/6W
R638	24366472	Res.Carbon	4. 7K	J 1/6W
R639	24366102	Res.Carbon	1K	J 1/6W
R640	24366152	Res.Carbon	1. 5K	J 1/6W
R641	24366223	Res.Carbon	22K	J 1/6W
R642	24366102	Res.Carbon	1K	J 1/6W
R643	24982399	Res.Metal	3. 9	J 1/2W
R644	24366223	Res.Carbon	22K	J 1/6W
R645	24367392	Res.Carbon	3. 9K	G 1/6W
R646	24367162	Res.Carbon	1. 6K	G 1/6W
R647	24367471	Res.Carbon	470	G 1/6W
R648	24367911	Res.Carbon	910	G 1/6W
R649	24366222	Res.Carbon	2. 2K	J 1/6W
R651	24066957	Res.Variabel	200	
R652	24066955	Res.Variable	1K	
R663	24366103	Res.Carbon	10K	J 1/6W
R664	24366103	Res.Carbon	10K	J 1/6W
R665	24366274	Res.Carbon	270K	J 1/6W
R666	24366274	Res.Carbon	270K	J 1/6W
R667	24366332	Res.Carbon	3. 3K	J 1/6W
R668	24366472	Res.Carbon	4. 7K	J 1/6W
R669	24366133	Res.Carbon	13K	J 1/6W
R670	24366102	Res.Carbon	1K	J 1/6W
R671	24366102	Res.Carbon	1K	J 1/6W
R675	24366102	Res.Carbon	1K	J 1/6W
R677	24366102	Res.Carbon	1K	J 1/6W
R678	24366103	Res.Carbon	10K	J 1/6W
R679	24366103	Res.Carbon	10K	J 1/6W
R680	24366103	Res.Carbon	10K	J 1/6W
R681	24366471	Res.Carbon	470	J 1/6W
R682	24366391	Res.Carbon	390	J 1/6W
R683	24366181	Res.Carbon	180	J 1/6W
R684	24366272	Res.Carbon	2. 7K	J 1/6W
R686	24366473	Res.Carbon	47K	J 1/6W
R691	24366271	Res.Carbon	270	J 1/6W
R692	24366391	Res.Carbon	390	J 1/6W
R693	24366271	Res.Carbon	270	J 1/6W
R694	24366391	Res.Carbon	390	J 1/6W
R695	24366431	Res.Carbon	430	J 1/6W
R696	24366431	Res.Carbon	430	J 1/6W
R697	24366103	Res.Carbon	10K	J 1/6W
R698	24366103	Res.Carbon	10K	J 1/6W
R699	24366103	Res.Carbon	10K	J 1/6W
R860	24553102	Res.Oxide Metal	1K	J 1W
R862	24383621	Res.Oxide Metal	620	J 2W
R863	24366472	Res.Carbon	4. 7K	J 1/6W
R865	24380132	Res.Carbon	1. 3K	J 1/8W
R867	24366241	Res.Carbon	240	J 1/6W
RA01	24366303	Res.Carbon	30K	J 1/6W
RA02	24366103	Res.Carbon	10K	J 1/6W
RA03	24366153	Res.Carbon	15K	J 1/6W
RA04	24366103	Res.Carbon	10K	J 1/6W
RA05	24366103	Res.Carbon	10K	J 1/6W
RA06	24366271	Res.Carbon	270	J 1/6W
RA08	24366472	Res.Carbon	4. 7K	J 1/6W
RA10	24366203	Res.Carbon	20K	J 1/6W
RA11	24366203	Res.Carbon	20K	J 1/6W

LOCATION NUMBER	PART NUMBER	DESCRIPTION		
RA12	24366203	Res.Carbon	20K	J 1/6W
RA13	24366203	Res.Carbon	20K	J 1/6W
RA14	24366472	Res.Carbon	4. 7K	J 1/6W
RA15	24366472	Res.Carbon	4. 7K	J 1/6W
RA17	24366472	Res.Carbon	4. 7K	J 1/6W
RA18	24366153	Res.Carbon	15K	J 1/6W
RA19	24366153	Res.Carbon	15K	J 1/6W
RA20	24366101	Res.Carbon	100	J 1/6W
RA21	24366433	Res.Carbon	43K	J 1/6W
RA22	24360102	Res.Carbon	1K	J 1/8W
RA30	24366101	Res.Carbon	100	J 1/6W
RS01	24366474	Res.Carbon	470K	J 1/6W
RS02	24366472	Res.Carbon	4. 7K	J 1/6W
RS03	24366472	Res.Carbon	4. 7K	J 1/6W
RS07	24366753	Res.Carbon	75K	J 1/6W
RS10	24366204	Res.Carbon	200K	J 1/6W
RS20	24366512	Res.Carbon	5. 1K	J 1/6W
RS21	24366102	Res.Carbon	1K	J 1/6W
RS22	24366472	Res.Carbon	4. 7K	J 1/6W
RS23	24366154	Res.Carbon	150K	J 1/6W
RS24	24366164	Res.Carbon	160K	J 1/6W
RS27	24366103	Res.Carbon	10K	J 1/6W
RS28	24366472	Res.Carbon	4. 7K	J 1/6W
RS29	24366472	Res.Carbon	4. 7K	J 1/6W
RS30	24366102	Res.Carbon	1K	J 1/6W
RS31	24366272	Res.Carbon	2. 7K	J 1/6W
RS32	24000952	Res.Thermistor	3K	K
RS33	24366104	Res.Carbon	100K	J 1/6W
RS34	24366624	Res.Carbon	620K	J 1/6W
RS51	24066873	Res.Variabel	100K	
RS53	24066922	Res.Variable	200K	
RS54	24066928	Res.Variable	2K	
RS55	24066927	Res.Variable	5K	
RS56	24066923	Res.Variable	100K	
RS57	24066923	Res.Variable	100K	
MISCELLANEOUS				
P501	23164497	PLUG		
P503	23164506	PLUG 2P		
SA01	23145509	Push Switch.1C1P		
SA02	23145509	Push Switch.1C1P		
SA03	23145509	Push Switch.1C1P		
SA04	23145509	Push Switch.1C1P		
SA05	23145509	Push Switch.1C1P		
SA06	23145509	Push Switch.1C1P		
X601	23153949	Ceramic Resonator	TCR1003.4MHz	
Z601	24000788	Resistor BLOCk	4. 7Kx4	
ZA01	23153949	Ceramic Resonator	TCR1003.4MHz	
		LOGIC 2 BOARD		
U601	70194770	P.C.Board Ass'y.LOGIC 2		
TRANSISTORS				
QL61	A6332430	Transistor	2SC2458Y	
QL62	A6332430	Transistor	2SC2458Y	
QL63	A6002040	Transistor	RN1204	
DIODES				
DL61	A7246711	Diode	1S1555(TV)	
DL62	A7246711	Diode	1S1555(TV)	
CAPACITORS				
CL61	24636100	Cap.Electrolytic	10MF	M 50V
RESISTORS				
RL61	24360473	Res.Carbon	47K	J 1/8W
RL62	24360473	Res.Carbon	47K	J 1/8W
RL63	24360472	Res.Carbon	4.7k	J 1/8W
RL64	24360513	Res.Carbon	51K	J 1/8W
RL65	24360513	Res.Carbon	51K	J 1/8W
RL66	24360223	Res.Carbon	22K	J 1/8W
RL67	24360472	Res.Carbon	4:7k	J 1/8W

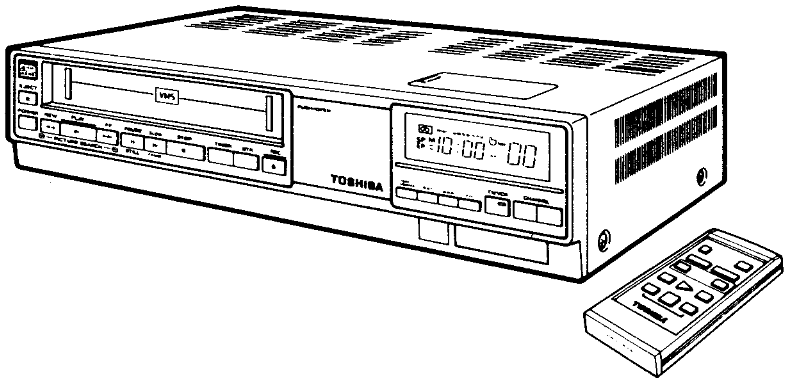
LOCATION NUMBER	PART NUMBER	DESCRIPTION		
POWER 1 BOARD				
U802	70194812	P.C.Board Ass'y.POWER 1		
INTEGRATED CIRCUITS				
IC810	B0351500	IC	TA75902P	
TRANSISTORS				
Q803	A6325540	Transistor	SC2236-Y	
Q804	A6848520	Transistor	2SD880-Y	
Q805	A6002010	Transistor	RN1201	
Q806	70114344	Transistor	2SD1198A-Q	
Q807	A6325540	Transistor	SC2236-Y	
DIODES				
⚠D801	23118485	Diode	ERC04-02F	
⚠D802	23118485	Diode	ERC04-02F	
⚠D803	23118485	Diode	ERC04-02F	
⚠D804	23118485	Diode	ERC04-02F	
D805	A7246711	Diode	1S1555(TV)	
D806	A7246711	Diode	1S1555(TV)	
D807	70115408	Diode,Zener	EQA02-05D	
D808	A7151450	Diode	1SS200	
D809	A7986480	Diode	S5500G	
⚠D811	A7986480	Diode	S5500G	
⚠D811	23118486	Diode	ERA15-02	
⚠D812	A7986480	Diode	S5500G	
⚠D812	23118486	Diode	ERA15-02	
CAPACITORS				
C802	24232103	Cap.Ceramic	0. 01MF	Z 50V
C803	24232103	Cap.Ceramic	0. 01MF	Z 50V
⚠C804	24630924	Cap.Electrolytic	4700MF	M 35V
C806	24795330	Cap.Electrolytic	33MF	M 25V
C807	24633220	Cap.Electrolytic	22MF	M 16V
C808	24633220	Cap.Electrolytic	22MF	M 16V
⚠C810	24794332	Cap.Electrolytic	3300MF	M 16V
C812	24633220	Cap.Electrolytic	22MF	M 16V
⚠C813	24799470	Cap.Electrolytic	47MF	M 16V
⚠C814	24799470	Cap.Electrolytic	47MF	M 16V
C815	24636010	Cap.Electrolytic	1MF	M 50V
RESISTORS				
⚠R801	24942335	Res.Solid	3. 3M	J 1/2W
R802	24552102	Res.Oxide Metal	1K	J 1/2W
R803	24360511	Res.Carbon	510	J 1/8W
R804	24360471	Res.Carbon	470	J 1/8W
R805	24378432	Res.Carbon	4. 3K	G 1/8W
R806	24378392	Res.Carbon	3. 9K	G 1/8W
R807	24378332	Res.Carbon	3. 3K	G 1/8W
R808	24378242	Res.Carbon	2. 4K	G 1/8W
R809	24360202	Res.Carbon	2K	J 1/8W
⚠R811	24531220	Res.Fusible	22	J 1/2W
R812	24360431	Res.Carbon	430	J 1/8W
R813	24360182	Res.Carbon	1. 8K	J 1/8W
R815	24360103	Res.Carbon	10K	J 1/8W
R816	24360104	Res.Carbon	100K	J 1/8W
⚠R817	24556189	Res.Fusible	0. 18	K 1/2W
R819	24360471	Res.Carbon	470	J 1/8W
R820	24360511	Res.Carbon	510	J 1/8W
MISCELLANEOUS				
⚠F801	23144879	Fuse 250v 0.6A		
⚠F801A	23165102	Fuse Holder		
⚠F802	23144897	Fuse 125V 2. 0A		
⚠F802A	23165102	Fuse Holder		
⚠F803	23144880	Fuse 250V 0.4A		
⚠F803A	23165102	Fuse Holder		
P804	23164506	PULG 2P		
POWER TR BOARD				
U803	70194813	P.C.Board Ass'y.POWER TR		
TRANSISTORS				
Q801	A6867970	Transistor	2SD1405BL	
Q802	A6867970	Transistor	2SD1405BL	
LOGIC SW BOARD				
UL01	70194686	P C Board Assy.Logic SW		
TRANSISTORS				
QX04	A6002060	Transistor	RN1206	
DIODES				
DL05	A8605671	Diode.LED	TLG113A(FA)	
DL07	A8605671	Diode.LED	TLG113A(FA)	
DX16	A7160570	Diode	1SS176	
DX17	A7160570	Diode	1SS176	
DX18	A8600606	Diode.LED	TLR113AD-FA	
CAPACITORS				
CX06	24793101	Cap.Electrolytic	100MF	M 10V
CX07	24474103	Cap.Ceramic	0. 01MF	N 50V
RESISTORS				
RX05	24366103	Res.Carbon	10K	J 1/6W
RX06	24366103	Res.Carbon	10K	J 1/6W
RX07	24366103	Res.Carbon	10K	J 1/6W
RX08	24366103	Res.Carbon	10K	J 1/6W
RX09	24366271	Res.Carbon	270	J 1/6W
MISCELLANEOUS				
SL03	23145510	Push Switch.1C1P		
SL04	23145510	Push Switch.1C1P		
SL05	23145510	Push Switch.1C1P		
SL06	23145510	Push Switch.1C1P		
SL07	23145510	Push Switch.1C1P		
SL08	23145510	Push Switch.1C1P		
SL09	23145510	Push Switch.1C1P		
SX04	23145510	Push Switch.1C1P		
SX19	23145510	Push Switch.1C1P		
FRONT LOADING (L) BOARD				
UM02	70194600	P C Board Assy.F/L(L)		
CAPACITORS				
CM21	24232103	Cap.Ceramic	0. 01MF	Z 50V
FRONT LOADING (R) BOARD				
UM03	70194601	P C Board Assy.F/L(R)		
CAPACITORS				
CM31	24232103	Cap.Ceramic	0. 01MF	Z 50V
REEL SENSOR (S) BOARD				
UM04	70194602	P C Board Assy.ReeL Sensor(S)		
REEL SENSOR (T) BOARD				
UM05	70194603	P C Board Assy.Reel Sensor (T)		
CAM SW BOARD				
UM06	70194604	P C Board Assy.Cam SW		
MISCELLANEOUS				
SM61	23145440	Cam Switch		
ACE HEAD BOARD				
UM07	70194605	P C Board Assy.ACE HEAD		
RESISTORS				
RM71	24366100	Res.Carbon	10	J 1/6W
LOADING MOTOR BOARD				
UM08	70194606	P C Board Assy.Loading Motor		
TIMER DISPLAY BOARD				
UX02	70194687	P C Board Assy.Timer Display		
INTEGRATED CIRCUITS				
ICR01	23119566	IC	UPC1474HA	
ICX01	70119542	IC	TMP47C410AN6784	
TRANSISTORS				
QX02	A6332430	Transistor	2SC2458-Y	
QX03	A6002020	Transistor	RN1202	
DIODES				
DL01	A8600606	Diode.LED	TLR113AD-FA	
DL02	A8600606	Diode.LED	TLR113AD-FA	
DR01	23115800	Diode.Photo	PH-302	
DX01	A7160570	Diode	1SS176	
DX02	A7160570	Diode	1SS176	
DX03	A7160570	Diode	1SS176	
DX04	A7160570	Diode	1SS176	
DX07	A7160570	Diode	1SS176	
DX09	A7160570	Diode	1SS176	
DX10	A7160570	Diode	1SS176	
DX11	A7160570	Diode	1SS176	
DX12	A7160570	Diode	1SS176	
DX13	A7160570	Diode	1SS176	

LOCATION NUMBER	PART NUMBER	DESCRIPTION		
DX14	A7160570	Diode	1SS176	
DX15	A7160570	Diode	1SS176	
COILS				
LR01	23238722	Coil.Peaking	TRF4822A1	
LR51	23232963	Coil.Variable	TRF3055	
CAPACITORS				
CR01	24202330	Cap.Electrolytic	33MF	M 10V
CR02	24203100	Cap.Electrolytic	10MF	M 16V
CR03	24203100	Cap.Electrolytic	10MF	M 16V
CR04	24593222	Cap.Plastic	2200PF	J 50V
CR05	24538683	Cap.Plastic	0. 068MF	J 50V
CR06	24501222	Cap.Plastic	2200PF	J 50V
CR07	24202470	Cap.Electrolytic	47MF	M 10V
CX01	24793101	Cap.Electrolytic	100MF	M 10V
CX02	24473470	Cap.Ceramic	47PF	J 50V
CX03	24473470	Cap.Ceramic	47PF	J 50V
CX04	24474103	Cap.Ceramic	0. 01MF	N 50V
CX05	24474103	Cap.Ceramic	0. 01MF	N 50V
RESISTORS				
R556	24069755	Res.Variable	100K	
RR01	24366222	Res.Carbon	2. 2K	J 1/6W
RR02	24366100	Res.Carbon	10	J 1/6W
RR03	24366562	Res.Carbon	5. 6K	J 1/6W
RR04	24366223	Res.Carbon	22K	J 1/6W
RS58	24066841	Res.Variable	500K	
RX02	24366223	Res.Carbon	22K	J 1/6W
RX04	24366103	Res.Carbon	10K	J 1/6W
RX10	24366222	Res.Carbon	2. 2K	J 1/6W
RX11	24366223	Res.Carbon	22K	J 1/6W
RX12	24366223	Res.Carbon	22K	J 1/6W
RX13	24366223	Res.Carbon	22K	J 1/6W
RX14	24366223	Res.Carbon	22K	J 1/6W
RX15	24366223	Res.Carbon	22K	J 1/6W
RX16	24366223	Res.Carbon	22K	J 1/6W
RX18	24366223	Res.Carbon	22K	J 1/6W
RX19	24366102	Res.Carbon	1K	J 1/6W
RX41	24941475	Res.Solid	4. 7M	J 1/4W
MISCELLANEOUS				
GX01	70113082	FIP.FIP8QM7		
GX01A	70862480	FIP Holder		
SL01	23145510	Push Switch.1C1P		
SL02	23145510	Push Switch.1C1P		
SX01	23145510	Push Switch.1C1P		
SX02	23145510	Push Switch.1C1P		
SX03	23145510	Push Switch.1C1P		
SX05	23145533	Slide Switch.2C2P		
SX06	23145510	Push Switch.1C1P		
SX07	23145510	Push Switch.1C1P		
SX08	23145510	Push Switch.1C1P		
SX09	23145510	Push Switch.1C1P		
SX10	23145510	Push Switch.1C1P		
SX11	23145510	Push Switch.1C1P		
SX12	23145510	Push Switch.1C1P		
SX13	23145510	Push Switch.1C1P		
SX14	23145532	Slide Switch.2C3P		
SX15	23145510	Push Switch.1C1P		
SX16	23145510	Push Switch.1C1P		
SX17	23145510	Push Switch.1C1P		
SX18	23145510	Push Switch.1C1P		
XX01	23153847	Resonator.4MHz.TCR1014		
ZX01	24000813	Resistor Block 82K x9		
ZX02	24000814	Resistor Block 82K x4		
ZX03	24000814	Resistor Block 82K x4		
		COMPONENTS		
		NOT MOUNTED ON P.C.BOARD		
H002	70123083	RF MOD.MSU911A		
H003	23142559	ANT Terminal.VTU818		
⚠R061	24942155	Res.Composition	1.5M	J 1/2W
DE01	70115406	Diode.LED	GL450V	
RG01	70213103	Dew Heater		
⚠T801	23213700	Transformer.TPW1360AN		
⚠S801	23367055	Switch		
⚠P801	23176755	Power Cord		
⚠P801A	70846159	Cord Holder		

LOCATION NUMBER	PART NUMBER	DESCRIPTION

SERVICE DATA
FILE NO.030-145-4

TOSHIBA
COLOR VIDEO CASSETTE RECORDER
M-5530TL
ADJUSTMENT PROCEDURES



SPECIFICATIONS

GENERAL
Video recording system: Rotary 2-head helical scanning
Head configuration: 4-head rotary (Dedicated heads for SP & EP)
Video signal: EIA standard NTSC color
Storage temperature: −20°C to +60°C (−4°F to +140°F)
Operating temperature: 5°C to 40°C (41°F to 104°F)
Antenna: 75 ohms external antenna terminal for VHF
300 ohms external antenna terminal for UHF
Channel coverage: VHF channels 2 – 13
UHF channels 14 – 83
CATV channels A_2, A_1, A – I, J – W, AA – JJ
VHF output signal: Channel 3 or 4 (selectable)
73 dBμ, 75 ohms unbalanced

SETTING POSITION	CHANNEL
VL ch	2 – 6
VH ch	A_2, A_1, A – I, 7 – 13
U ch	14 – 83
CATV ch	J – W, AA – JJ

Power consumption: 34W (8W with power off)
Weight: 17.2 lb.
Dimensions: 16-15/16 x 3-3/4 x 14-3/4 inches (W.H.D)

VIDEO
Input: VIDEO LINE IN:
Phono jack
1.0V(p-p)
75 ohms unbalanced, sync. negative

VIDEO
Output: VIDEO LINE OUT:
Phono jack
1.0V(p-p) 75 ohms unbalanced, sync. negative
Signal to noise ratio: [SP]: 45 dB

AUDIO
Input: AUDIO LINE IN:
Phono jack, 47k ohms, −10 dBs, unbalanced
Output: AUDIO LINE OUT:
Phono jack, less than 10k ohms, −7 dBs, unbalanced (load: more than 47k ohms)
Frequency response: [SP]: 80 Hz to 12 kHz
Signal to noise ratio: [SP]: Better than 40 dB

TAPE TRANSPORT
Tape speed: SP 33.35 mm/sec., LP16.67 mm/sec., EP 11.12 mm/sec.
Maximum recording time: 480 min. with T-160 tape (EP mode)
Fast forward time: Within 5.0 min. (T-120)
Rewind time: Within 5.0 min. (T-120)

TIMER
Fluorescent digital display
Count down from AC line frequency.

Remote Control Unit
12 key: 17 modes. Infared Remote Control Operation

Design and specifications are subject to change without notice.

Caution: The unauthorized recording of television programmes and other materials may infringe on the rights of others.

SAFETY NOTICE

SAFETY PRECAUTIONS

LEAKAGE CURRENT CHECK

Plug the AC line cord directly into a 120V AC outlet (do not use an isolation transformer for this check). Use an AC voltmeter, having 5000 ohms per volt or more sensitivity.

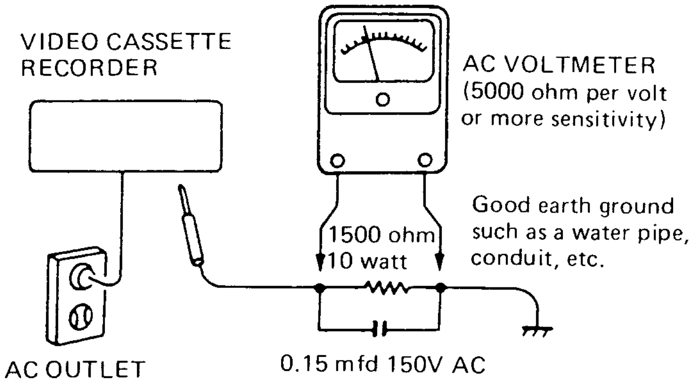
Connect a 1500 ohm 10 watt resistor, paralleled by a 0.15 mfd 150V AC capacitor between a known good earth ground (water pipe, conduit, etc.) and all exposed metal parts of cabinet (antennas, handle bracket, metal cabinet, screwheads, metal overlays, control shafts, etc.).

Measure the AC voltage across the 1500 ohm resistor. The test must be conducted with the AC switch on and then repeated with the AC switch off. The AC voltage indicated by the meter may not exceed 0.3 volts. A reading exceeding 0.3 volts indicates that a dangerous potential exists, the fault must be located and corrected.

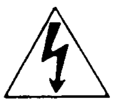
Repeat the above test with the VCR power plug reversed.

NEVER RETURN A VCR TO THE CUSTOMER WITHOUT TAKING NECESSARY CORRECTIVE ACTION.

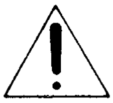
READING SHOULD NOT EXCEED 0.3V


VIDEO CASSETTE RECORDER
AC VOLTMETER (5000 ohm per volt or more sensitivity)
1500 ohm 10 watt
Good earth ground such as a water pipe, conduit, etc.
AC OUTLET
0.15 mfd 150V AC

Test all exposed metal.
Voltmeter Hook-up for Leakage Current Check



The lightning flash with arrowhead symbol, within an equilateral triangle, is intended to alert the user to the presence of uninsulated "dangerous voltage" within the product's enclosure that may be of sufficient magnitude to constitute a risk of electric shock to persons.



The exclamation point within an equilateral triangle is intended to alert the user to the presence of important operating and maintenance (servicing) instructions in the literature accompanying the appliance.

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1. MECHANICAL ADJUSTMENT 1
   - 1-1. Mechanical Parts Location 1
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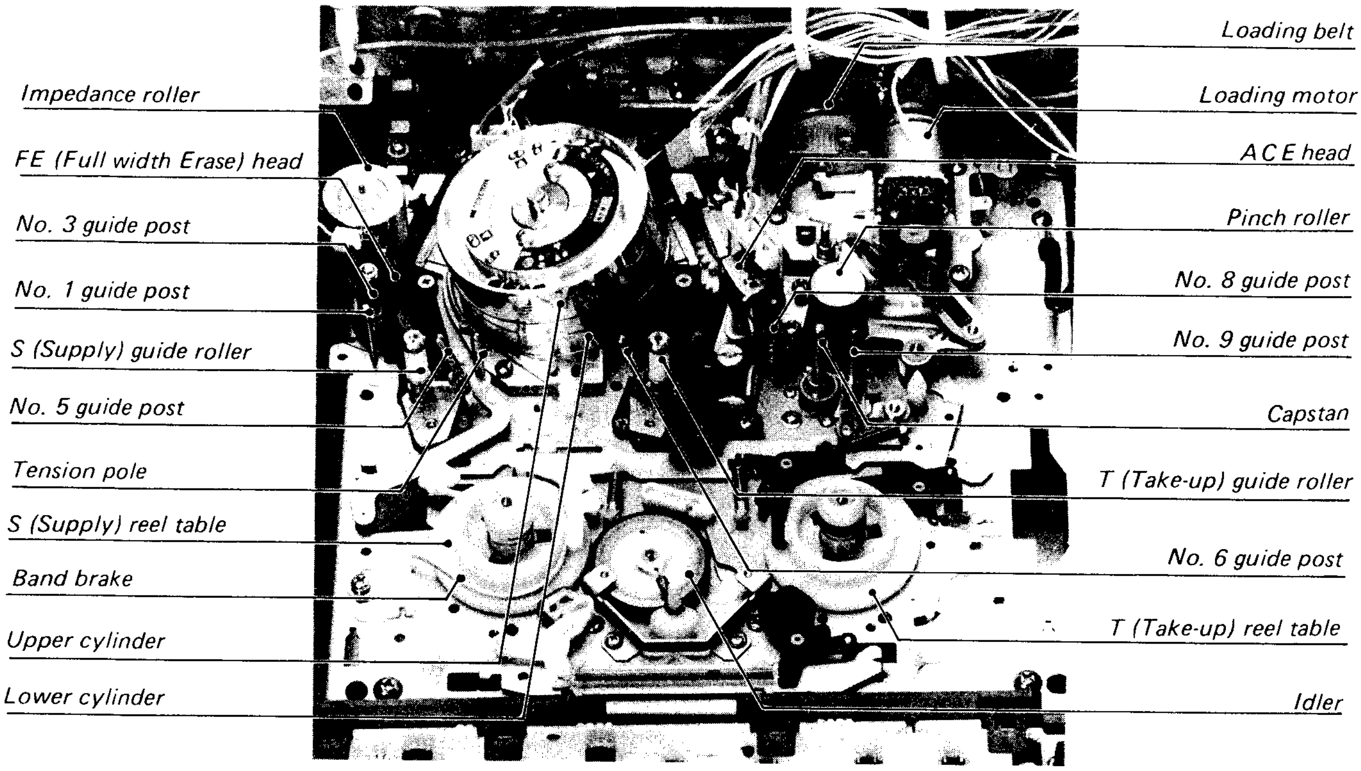
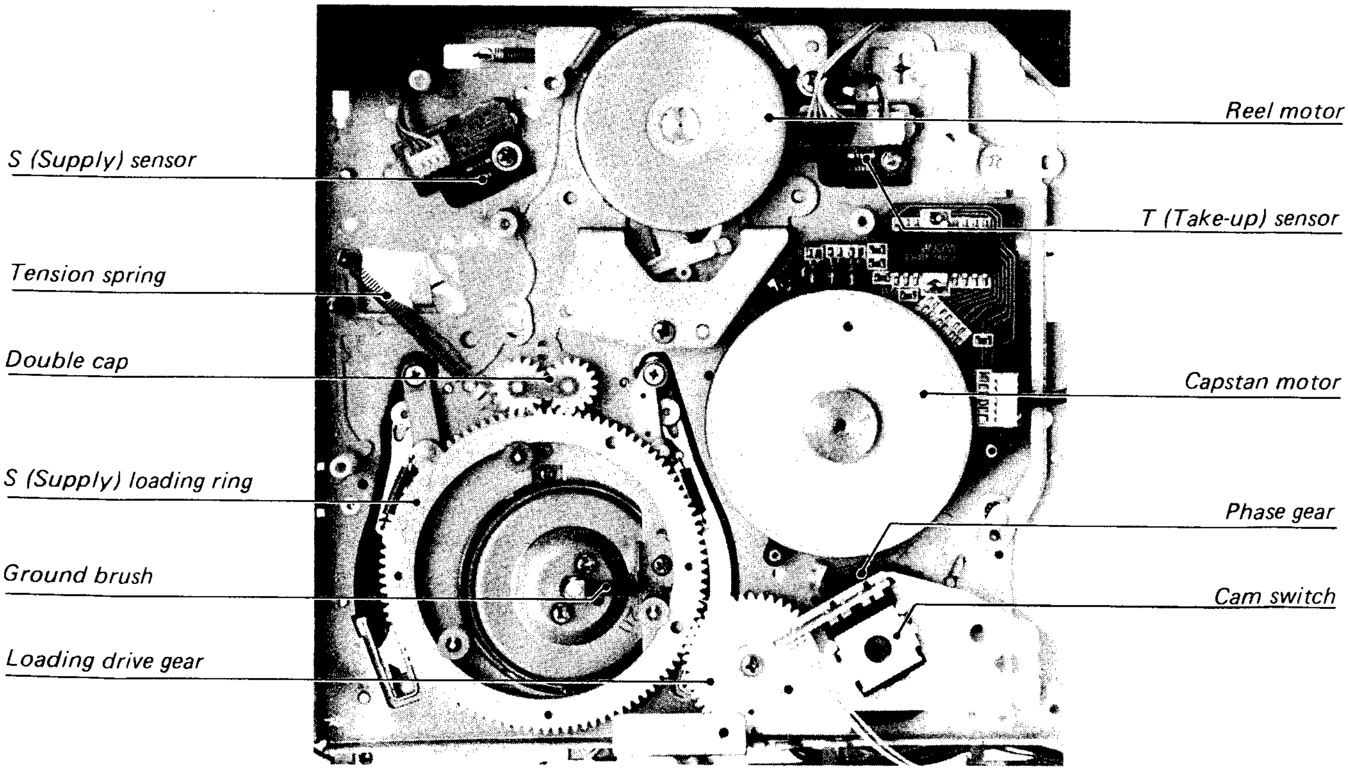
1. MECHANICAL ADJUSTMENT

1-1. Mechanical Parts Location

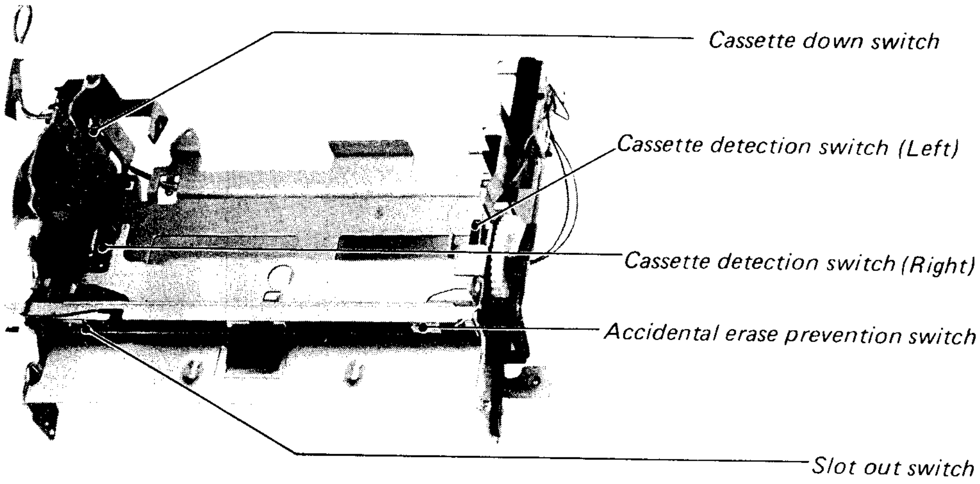
1-1-1 Top View

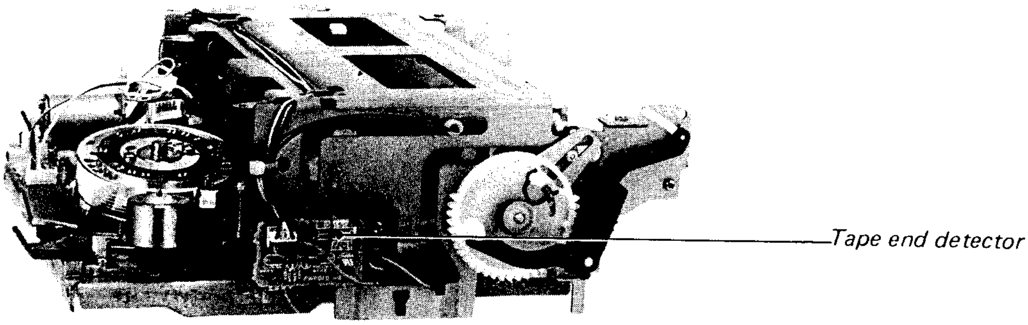

Impedance roller
FE (Full width Erase) head
No. 3 guide post
No. 1 guide post
S (Supply) guide roller
No. 5 guide post
Tension pole
S (Supply) reel table
Band brake
Upper cylinder
Lower cylinder
Loading belt
Loading motor
A C E head
Pinch roller
No. 8 guide post
No. 9 guide post
Capstan
T (Take-up) guide roller
No. 6 guide post
T (Take-up) reel table
Idler

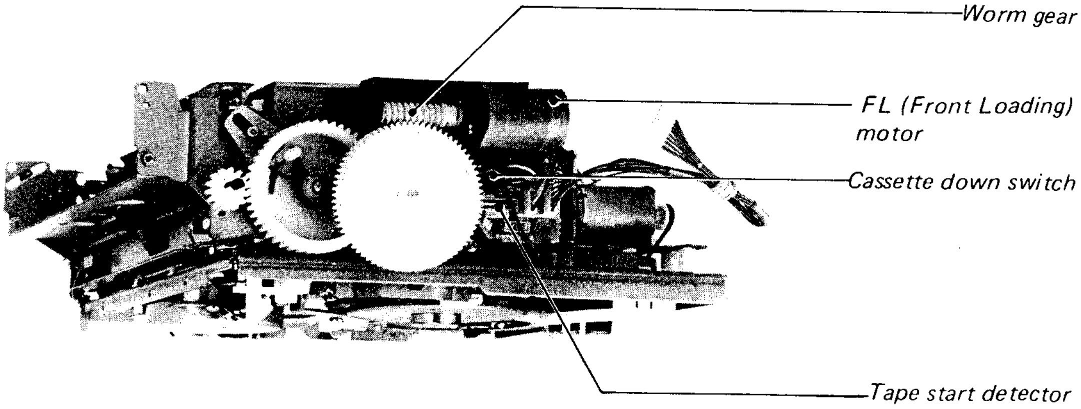
1-1-2 Bottom View


S (Supply) sensor
Tension spring
Double cap
S (Supply) loading ring
Ground brush
Loading drive gear
Reel motor
T (Take-up) sensor
Capstan motor
Phase gear
Cam switch

1-1-3 Front Loading Mechanism


Cassette down switch
Cassette detection switch (Left)
Cassette detection switch (Right)
Accidental erase prevention switch
Slot out switch


Tape end detector


Worm gear
FL (Front Loading) motor
Cassette down switch
Tape start detector

1-2. Servicing Jig List

Name	Part code	Q'ty	Sketch No.	Note
Alignment tape (MH-1)	70909110	1	①	
Alignment tape (MH-1L)	70909111	1	①	
Torque gauge	70909098	1	②	
Back tension cassette gauge	70909103	1	③	
Height gauge	70909113	1	④	
Taper nut driver	70909162	1	⑤	
Torque cassette gauge (KT-300NR)	70909199	1	⑥	NEW
Dental mirror	70954003		⑦	

Table 1-2-1

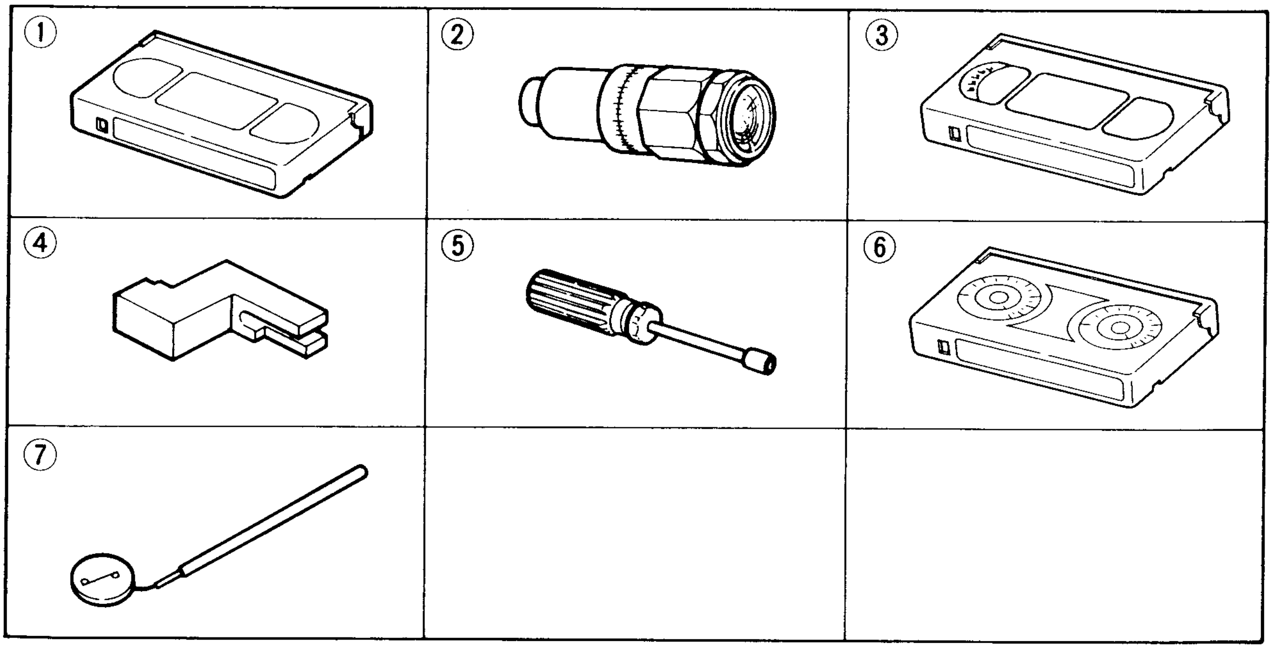


Fig. 1-2-1

1-3. Main Parts Replacement

1-3-1 Front Loading

(1) Front loading assembly

< Replacement >

1) Disconnect the relay cable connector from the Logic P.C. board .
2) Loosen 4 mounting screws on the deck top shield plate, and remove the shield plate.
3) Remove 2 screws securing the front loading assembly on the base.
4) First, pull the front loading assembly forward, unhook claws from the holes on the main base, and then take out the loading assembly upward, and replace it.

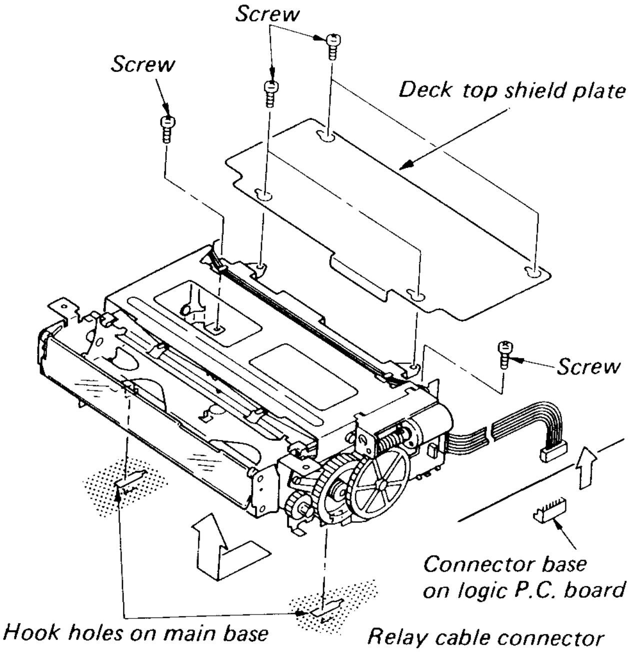

Screw
Screw
Deck top shield plate
Screw
Connector base on logic P.C. board
Hook holes on main base
Relay cable connector

Fig. 1-3-1 Front loading assembly replacement

(2) Door

< Replacement >

1) Slide the door rightward and remove the left door shaft from the guide bracket while warping the door slightly forward. Next, disengage the right door shaft.
2) Remove a door spring from the right door shaft and replace it.
3) Insert the door spring into the right door shaft of the new door (in direction shown by the arrow).
4) Insert the tip of door spring into the spring hook (hole) on the guide bracket, and insert the right door shaft into the guide bracket.
5) Insert the left door shaft into the guide bracket while warping the door slightly forward. In this case, make sure that the door lever pin is positioned as shown in Fig. 1-3-4.

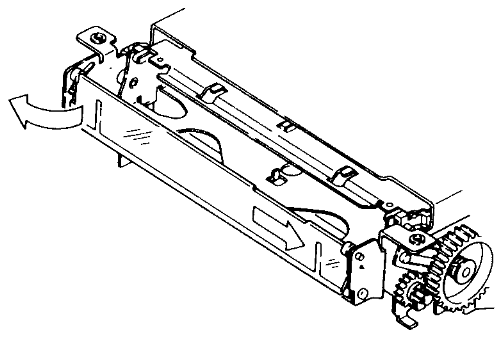


Fig. 1-3-2 Door replacement (1)

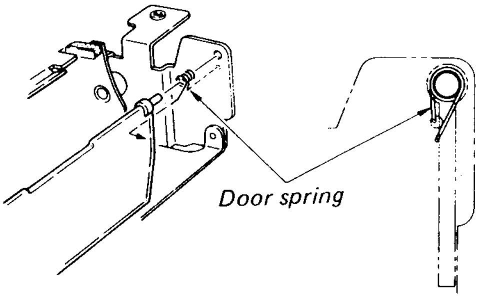

Door spring

Fig. 1-3-3 Door replacement (2)

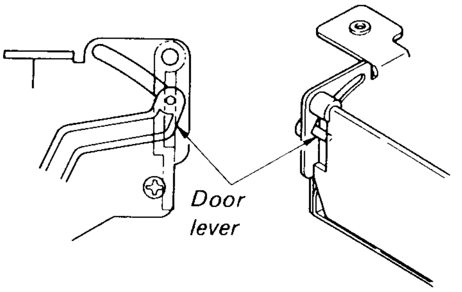


Fig. 1-3-4 Door replacement (3)

(3) Cassette detection switches, L, R

< Replacement >

1) Remove the front loading assembly from the chassis.
2) Place the front loading assembly upside down.
3) Unsolder leads from the switch terminals using a soldering iron. In this case, the unsoldering work will be made easily if the cassette holder is moved down by rotating the coupling section of the worm gear and the motor. (Do not touch your hand to gear teeth.)
4) Remove screws securing the switches and replace the switches.
5) When mounting new switches, perform the above steps in reverse order.

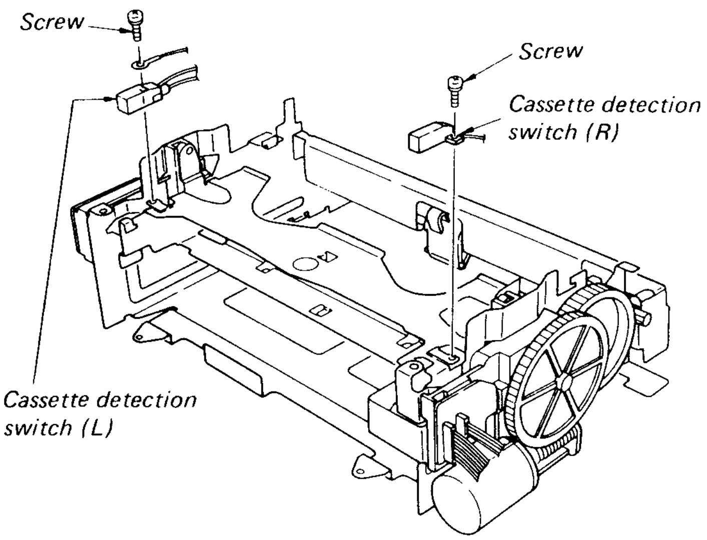

Screw
Screw
Cassette detection switch (R)
Cassette detection switch (L)

Fig. 1-3-5 Replacement of cassette detector

(4) Cassette down switch

< Replacement >

1) Remove the front loading assembly from the chassis.
2) Remove the FL P.C. board (R) unhooking the mold clows on the guide R.
3) Remove the screw securing the switch and take out the switch.
4) Unsolder the leads from the switch terminals using a soldering iron.
5) When remounting a new switch, perform the above steps in reverse order.

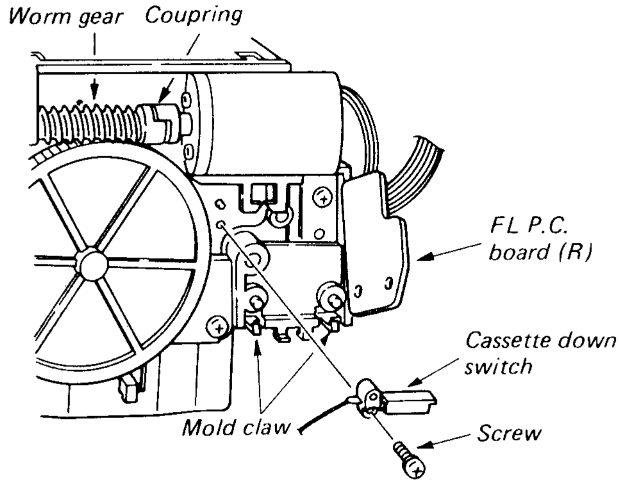

Worm gear
Coupring
FL P.C. board (R)
Cassette down switch
Mold claw
Screw

Fig. 1-3-6 Cassette down switch replacement

(5) Slot out switch and accidental erase prevention switch

1) Remove the front loading assembly from the chassis.
2) Place the loading assembly with the door facing upward.
3) Unsolder the leads from the switch terminals, using the soldering iron.
4) Remove the screw securing the switch.
5) When mounting the switch; perform the above steps in reverse order.

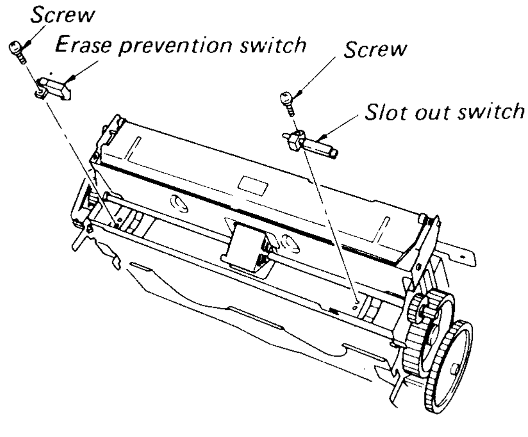

Screw
Erase prevention switch
Screw
Slot out switch

Fig. 1-3-7 Replacement of slot out switch and erase prevention switch

(6) FL motor assembly

< Replacement >

1) Remove the front loading assembly from the chassis.
2) Unsolder the leads from the motor terminals, using the soldering iron.
3) Remove the screws securing the FL motor assembly on the guide R and remove the assembly.
4) When mounting the assembly, perform the above steps in reverse order.

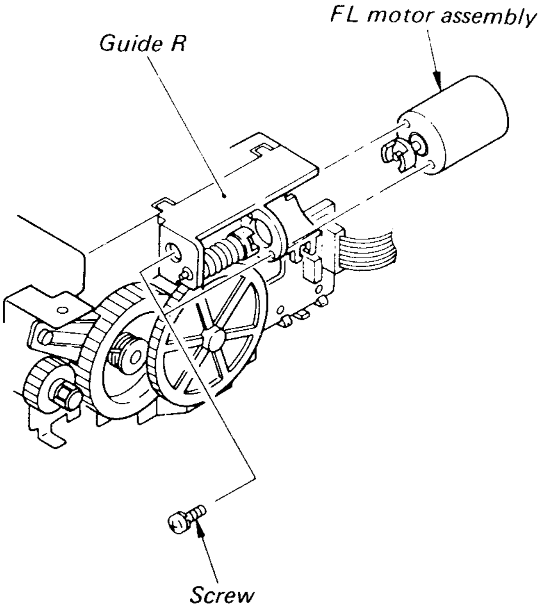

FL motor assembly
Guide R
Screw

Fig. 1-3-8 Replacement of motor assembly

(7) Photo transistor

< Replacement >

1) Remove the front loading assembly from the chassis.
2) Remove the FL P.C. board (R) unhooking the mold clows on the guide R.
3) Unsolder the photo transistor from the FL P.C. board, using the soldering iron.
4) Bend leads of a new photo transistor as shown in Fig. 1-3-11.
5) When remounting the transistor, perform the above steps in reverse order.
6) The replacement method will apply to both the photo transistors on the left and right FL P.C. boards.

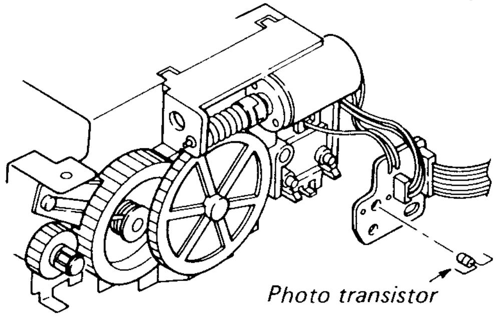


Photo transistor

Fig. 1-3-9 Replacement of photo transistors on FL P.C. board, (R)

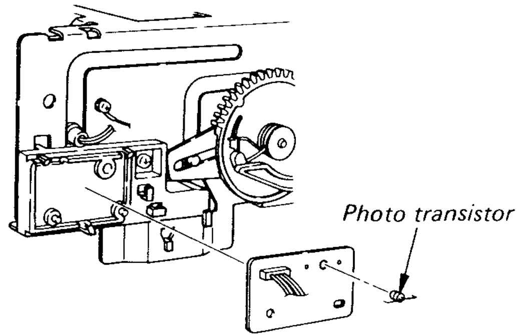


Photo transistor

Fig. 1-3-10 Replacement of photo transistor on FL P.C. board, (L)

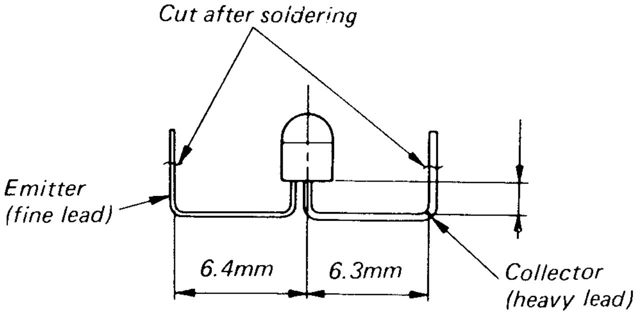

Cut after soldering
Emitter
(fine lead)
6.4mm
6.3mm
Collector
(heavy lead)

Fig. 1-3-11 Forming of photo transistor leads

1-3-2 Cylinder

(1) Upper Cylinder Assembly

< Inspection >

1) Check video heads damaged or worn out.
2) Check video heads clogging.
   (Replace the upper cylinder assembly if the clogging is not remedied after cleaning.)

< Replacement >

1) Unsolder the relay terminals ⑥ (at the marks △, 2 pairs – in total 4 locations) on the head relay P.C. board ①.
   The solder will be removed easily using a desoldering wire.
2) Remove two screws ② and remove the upper cylinder assembly.
3) Clean a new upper cylinder assembly ③ and the surface of the flange for mounting ⑤ , using a cleaning kit.
4) Align phases of the white part of P.C. board ① and P.C. board ④ and then mount the upper cylinder ③ . (Tightening torque ; 3 – 4 kg-cm.)
5) Perform the tape transport adjustment.

(2) Cylinder motor

Rotate the upper cylinder assembly.
The revolution in the play mode is 1800 r.p.m and controlled by a servo system.

< Inspection >

1) Apply power to the cylinder motor separately.
2) If the motor does not rotate, replace the rotor or the stator.

< Rotor replacement >

1) Remove the ground cap ①.
2) Remove two rotor screws ② and replace the rotor ③.
   (Tightening torque ; 3 – 4 kg-cm.)

Note: Mount a new rotor, matching the phase decision holes of rotor and preliminary pressure boss ④. (Fig. 1-3-14, 15)

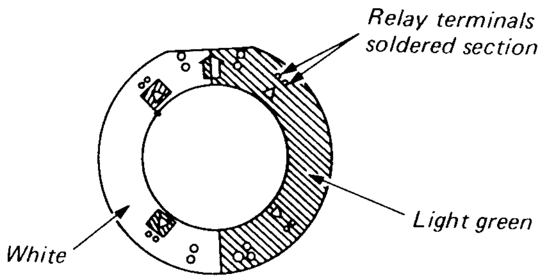

Relay terminals soldered section
Light green
White

Fig. 1-3-12 Head relay P.C. board ①

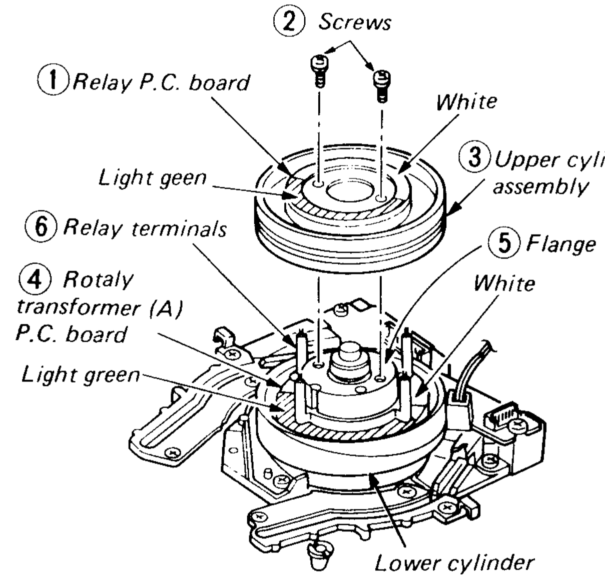

② Screws
① Relay P.C. board
White
Light geen
③ Upper cylinder assembly
⑥ Relay terminals
⑤ Flange
④ Rotaly transformer (A) P.C. board
White
Light green
Lower cylinder

Fig. 1-3-13 Upper cylinder replacement

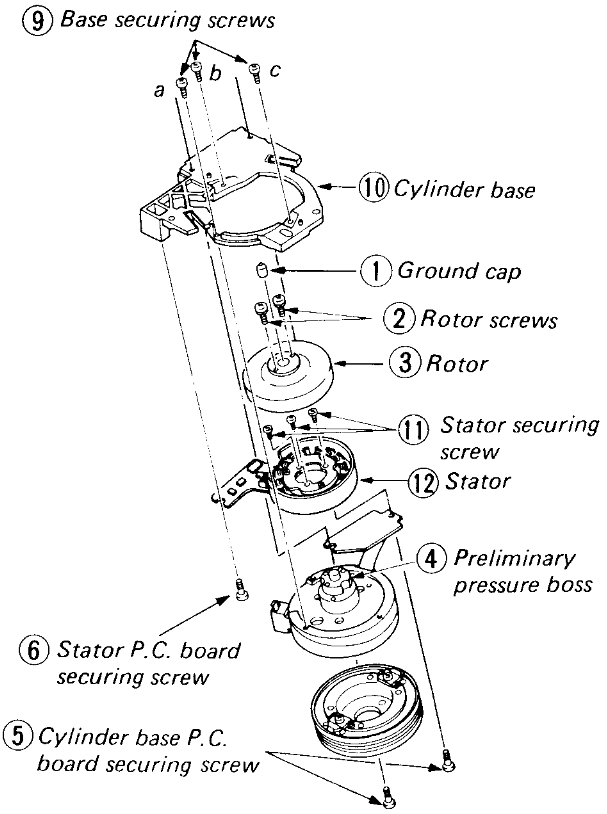

⑨ Base securing screws
a
b
c
⑩ Cylinder base
① Ground cap
② Rotor screws
③ Rotor
⑪ Stator securing screw
⑫ Stator
④ Preliminary pressure boss
⑥ Stator P.C. board securing screw
⑤ Cylinder base P.C. board securing screw

Fig. 1-3-14 Cylinder motor replacement

< Stator replacement >

1) Remove the cylinder assembly. (Refer to 1-3-2 (3))
2) Remove two cylinder base P.C. board securing screws ⑤and stator P.C. board securing screw ⑥. (Fig. 1-3-16)

> **Note:** In this case, take care not to damage patterns of the R.T. relay P.C. board. Also handle the cylinder base P.C. board ⑧ carefully so that the cylinder is not damaged with the P.C. board.

3) Remove three base securing screws ⑨and remove the cylinder base ⑩. (Fig. 1-3-14)
4) Remove the rotor screw②and the rotor③. (Fig. 1-3-14)

> **Note:** Follow the procedures under "< Rotor replacement >" mentioned on page 7 .

5) Remove the stator securing screw⑪.
6) Pull out the stator ⑫and replace it. (Tightening torque 1.5 – 2.5 kg)
7) When mounting the cylinder assembly, perform the above steps in reverse order.

> **Note:** Sequence of tightening base securing screws ⑨: tighten the screw a first, b and c in any order. (tightening torque is 3 – 4 kg-cm) (Fig. 1-3-14)

8) Perform the tape transport adjustment.

(3) Cylinder assembly

< Inspection >

1) Check to see that rotating surface of the lower cylinder has no damage such as scratches, crack, etc.
2) Check to see smooth rotation of the upper cylinder. If abnormality is found, replace the cylinder(s).

< Replacement >

1) Remove the 9P connector (Video heads) ① , 5P connector (Cylinder motor) ② , and the dew heater③.
2) Remove three screws ④.
3) Remove the cylinder assembly ⑤ .

> **Note:** In this case, move the impedance roller ⑥ in direction shown by the arrows.

4) Align position of a new cylinder to the cylinder base ⑦ , taking care not to touch the video heads directly and not to damage the cylinder surface. When mounting the cylinder complete assembly, perform the above steps in reverse order.
5) Perform the tape transport adjustment.

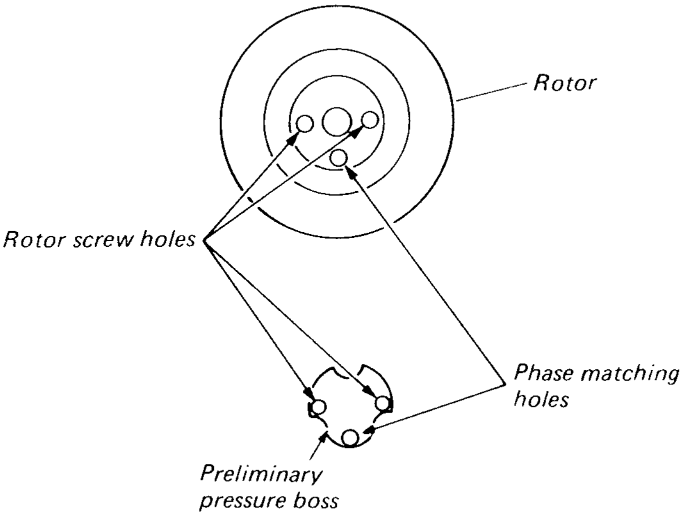

Rotor
Rotor screw holes
Phase matching holes
Preliminary pressure boss

Fig. 1-3-15 Phase matching between rotar and preliminary pressure boss

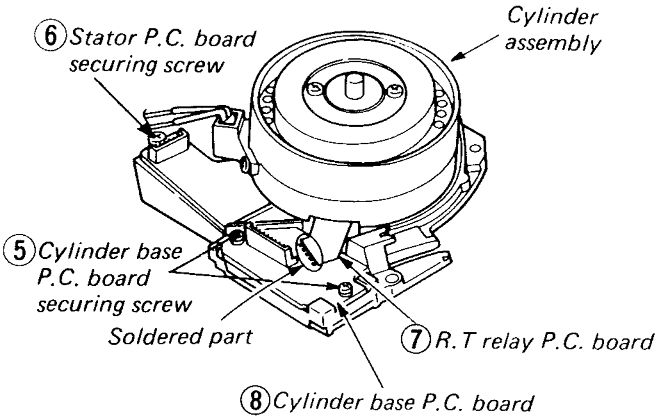

⑥Stator P.C. board securing screw
Cylinder assembly
⑤Cylinder base P.C. board securing screw
Soldered part
⑦R.T relay P.C. board
⑧Cylinder base P.C. board

Fig. 1-3-16 Relay P.C. board and cylinder base P.C. board

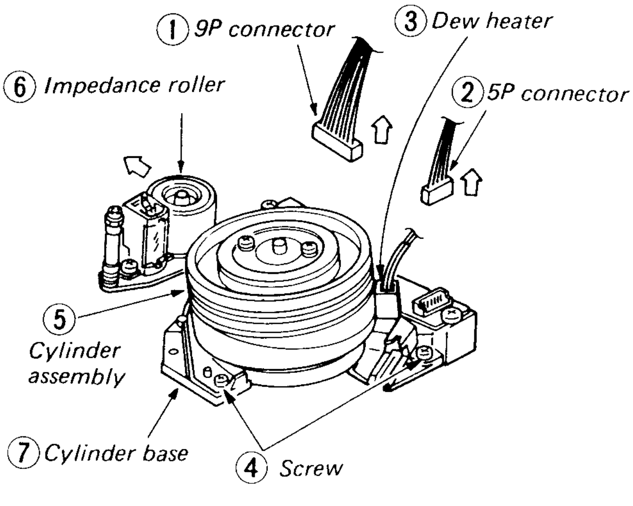

① 9P connector
③ Dew heater
⑥ Impedance roller
② 5P connector
⑤ Cylinder assembly
⑦ Cylinder base
④ Screw

Fig. 1-3-17 Cylinder assembly replacement

1-3-3 Transport system parts replacement

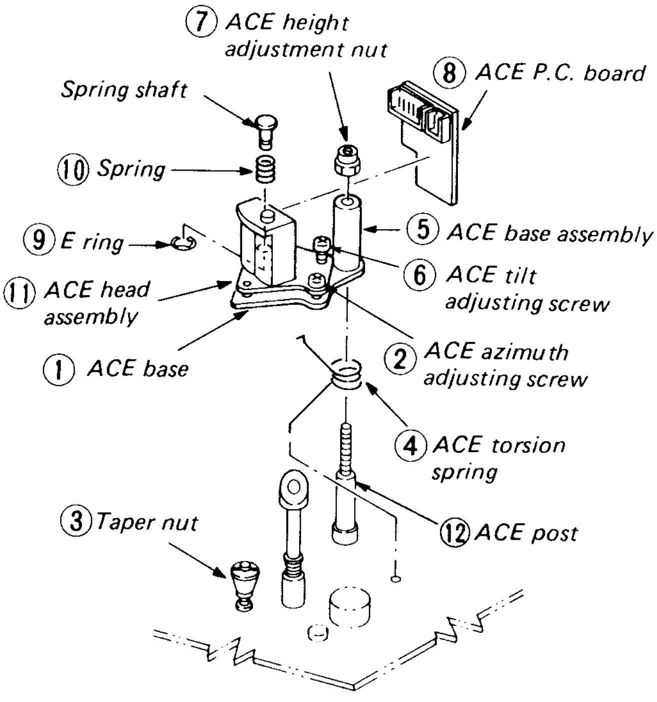
(1) ACE Head assembly replacement

1) Disconnect a 6P connector from the ACE P.C. board ⑧.
2) Turn the ACE height adjusting nut ⑦ counter-clockwise and remove the nut in order to remove ACE base assembly ⑤. Refer to Fig. 1-3-18.

> **Note:** Note positions of the ACE base ① and the taper nut ③.

3) Remove the E-ring ⑨ and the ACE azimuth adjusting screws ② in order to remove the ACE head assembly.
4) Remove the ACE P.C. board ⑧ from the ACE head assembly ⑪.
5) Replace the ACE head assembly, according to the reverse procedures.
6) Rotate the ACE height adjustment nut ⑦ until the ACE base and the upper position of the taper nut have the same position as noted in the step 2) above.
7) After mounting, perform the tape transport adjustment, starting from the first step.

> **Note:** Since direct mounting of the ACE torsion spring is difficult, first insert the tip of the spring into the hole on the main base and then hook the opposite tip of the spring to the ACE base ① which has been inserted into the ACE post ⑫.



⑦ ACE height adjustment nut
⑧ ACE P.C. board
Spring shaft
⑩ Spring
⑤ ACE base assembly
⑨ E ring
⑥ ACE tilt adjusting screw
⑪ ACE head assembly
① ACE base
② ACE azimuth adjusting screw
④ ACE torsion spring
③ Taper nut
⑫ ACE post

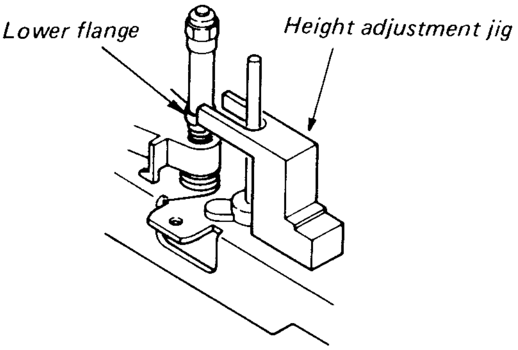
Fig. 1-3-18 Replacement of ACE head assembly

(2) Guide sleeve replacement

< No. 3 guide sleeve replacement >

1) Rotate the No. 3 guide nut ① counterclockwise and remove the No. 3 guide nut ① and flange ② as shown in Fig 1-3-22. When replacing a new flange, perform the above steps in reverse order.
2) After the replacement, preset height of the lower flange as shown in Fig. 1-3-19, using the guide height gauge.
3) After completion of preset, perform adjustments by following the procedures for Linearity Adjustment, item 4) of the Tape Transport Adjustment. (Refer to 1-4-4 (3))

> **Note:** The flange ② arranged in upper and lower positions is a common part and can be used upside down. (Fig. 1-3-22)



Lower flange
Height adjustment jig

Fig. 1-3-19 No. 3 guide replacement

< No. 8 guide sleeve replacement >

1) Remove No. 8 cap ① through the spring ⑦ in this sequence as shown in Fig. 1-3-20. When reassembling, perform the above steps in reverse order.
2) After completion of the replacement, preset height of the lower flange as shown in Fig. 1-3-21 using the guide height gauge.

Note: This adjustment is a basic reference of tape transport system, so extreme care should be paid in the adjustment.
When mounting the No. 8 guide cap ①, mount it with its slant surface facing to the cassette side.

3) After completion of the preset adjustment, perform adjustments by following the procedures for the linearity adjustment, item 4) of the tape transport adjustment. (Refer to 1-4-4 (3))

(3) FE head replacement

1) Disconnect the 2P connector of the FE head.
2) Remove the FE head mounting screw ⑤ and the FE head ⑥ will be removed. Refer to Fig. 1-3-22.
3) Replace the FE head and tighten the FE head mounting screw ⑤.
4) Connect 2P connector.
5) The replacement of the FE head causes little change in linearity. But confirm whether the associated adjustments have been not upset, starting check from the linearity adjustment, item 4) of the tape transport adjustment. (Refer to 1-4-4 (3))

(4) Impedance roller replacement

1) Remove the washer ⑦ and replace the impedance roller ⑧ as shown in Fig. 1-3-22.

Note: A poly slider is inserted between the impedance roller ⑧ and the entrance lever ⑩, taking care not to miss it. The impedance roller with scratches may damage tape, so carefully handle it.
If your fingers touch the surface of impedance roller, clean the surface with alcohol.

2) After replacement of the impedance roller, perfrom the adjustment from item 4) in the tape transport adjustment. (Refer to 1-4-4 (3))

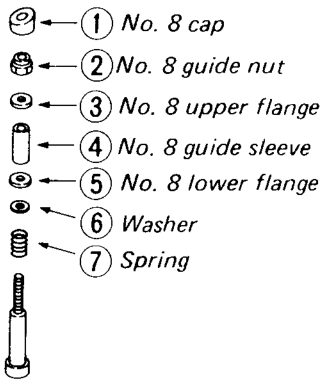

① No. 8 cap
② No. 8 guide nut
③ No. 8 upper flange
④ No. 8 guide sleeve
⑤ No. 8 lower flange
⑥ Washer
⑦ Spring

Fig. 1-3-20 No. 8 guide preset

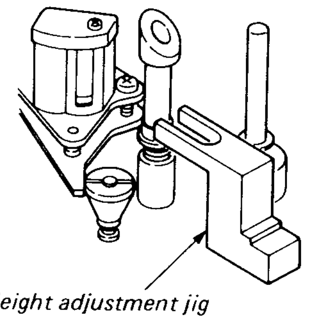

Height adjustment jig

Fig. 1-3-21 No. 8 guide preset

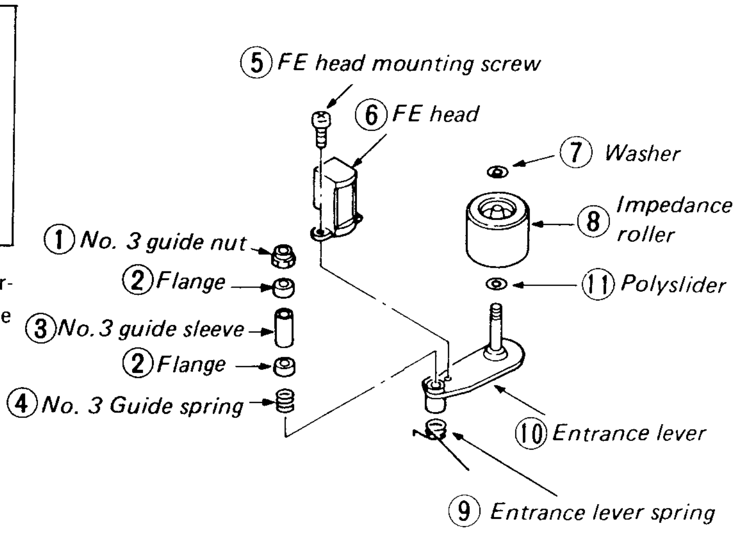

⑤ FE head mounting screw
⑥ FE head
⑦ Washer
⑧ Impedance roller
⑪ Polyslider
① No. 3 guide nut
② Flange
③ No. 3 guide sleeve
② Flange
④ No. 3 Guide spring
⑩ Entrance lever
⑨ Entrance lever spring

Fig. 1-3-22 Replacement of No. 3 guide and FE head

(5) S.T. Guide rollers replacement

Same replacement procedures will be applied for both S and T guide rollers.

1) Loosen the set screw ② shown in Fig. 1-3-23.
2) Turn the guide roller ① counterclockwise and remove it.
3) As the O-ring may stick to the guide roller removed, remove the O-ring and insert it on a new guide roller.
4) When remounting, perform the above steps in reverse order.

Note: When tightening the set screw ②, temporarily tighten it with light pressure. If it is tighten too hard, associated adjustments can not be made. The S guide roller has a red mark on upper flange and the T guide roller has a black mark on upper flange. Do not exchange them when remounting.

5) After completion of the replacement, perform adjustment from the item 4) in the tape transport adjustment. (Refer to 1-4-4 (3))

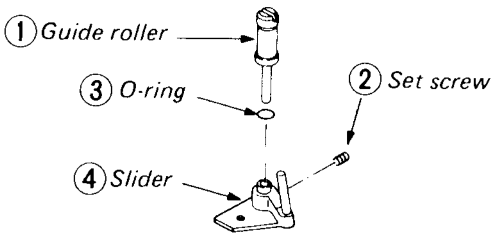


Fig. 1-3-23 Guide roller replacement

(6) S.T. Sliders replacement

1) Remove the cylinder assembly.
2) Place the VCR vertically and remove the bottom cover.
3) Remove the connecting screw ① shown in Fig. 1-3-24.
4) Move the slider up to the loading position turning loading motor with your hand, and the slider can be removed.
5) Remove the guide roller and reinstall it in a new slider according to the steps stated in (5) above.
6) When replacing the slider, perform the above steps in reverse order.
7) After completion of the replacement, perform adjustment from the item (3) in the tape transport adjustment.

Note: When the slider is replaced, always apply grease to the slider as shown in Fig. 1-3-24.

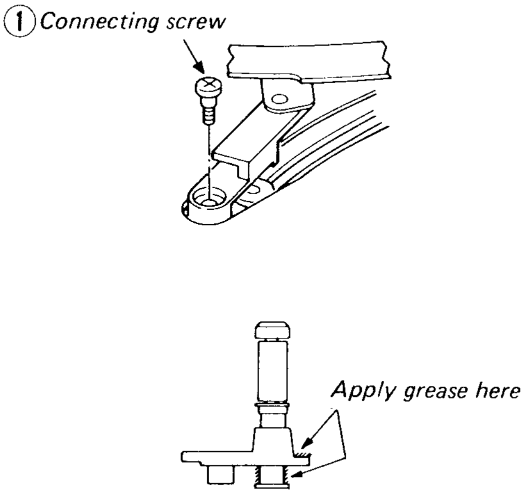


Fig. 1-3-24 S.T. slider replacement

(7) No. 9 guide lever assembly replacement

1) Remove the washer ① shown in Fig. 1-3-25
2) Remove the No. 9 guide lever assembly ② .
3) When replacing, perform the above steps in reverse order.

Note: When mounting the No. 9 guide lever assembly, temporarily hook the section-A of No. 9 guide spring ③ onto the cutout provided on the No. 9 guide lever. Then insert the spring onto the pin and finally unhook the section-A from the cutout.

4) After completion of the replacement, perform adjustment from the item 6) in the tape transport adjustment.

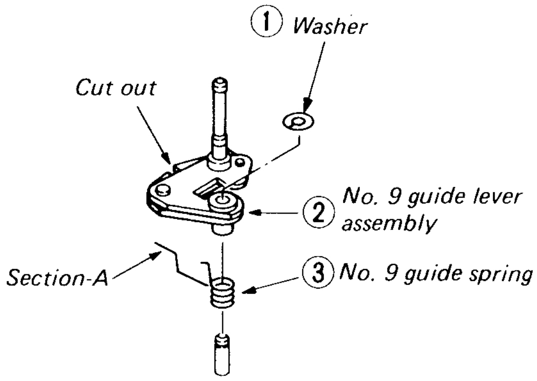


Fig. 1-3-25 No. 9 guide lever assembly replacement

1-3-4 Pinch roller assembly replacement

1) Remove the washer ① and disconnect the pinch connector from the pinch roller assembly.
2) Remove the washer ② and remove the pinch roller assembly upward.
3) Clean the pinch post and apply grease on it.
4) Replace the pinch lever assembly according the above steps in reverse order.
5) After completion of the replacement, perform adjustment from the item "1-4-4 (3) Tape transport system adjustment".

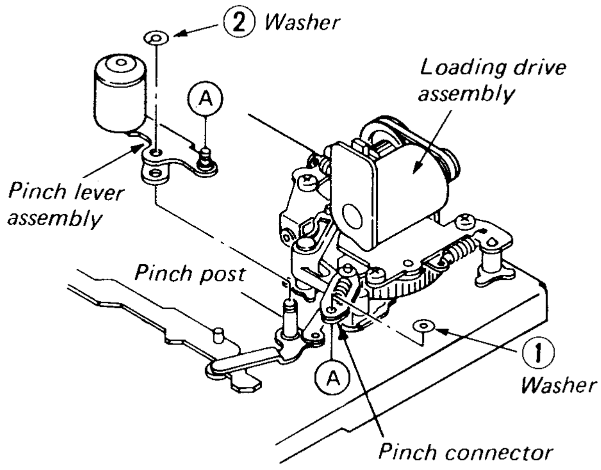

② Washer
Loading drive assembly
Ⓐ
Pinch lever assembly
Pinch post
① Washer
Ⓐ
Pinch connector

Fig. 1-3-26 Pinch roller replacement

1-3-5 Loading motor replacement

1) Remove the motor P.C. board from the motor, taking care not to damage wire leads.
2) Remove the washer ① and disconnect the pinch connector.
3) Remove the cam lever stopper and the washer ②, and remove the cam lever assembly upward.
4) Turn the gear pulley in direction shown by the arrow until it stops to set the FF/REW mode. (Refer to Fig. 1-3-28)
5) Remove the screw ③ and remove the loading drive assembly.
6) Remove the loading belt and the screw ④, and remove the motor.
7) Replace the motor.
   When replacing with a new motor, perform the above steps in reverse order, taking care of polarities, (+ polarity should be located on upside).
8) When mounting the loading drive assembly on the main base, first push the logic slider rightward (shown by the arrow) until it stops, and then mount the drive assembly.
9) Confirm timing of the phase gear, refer to 1-4-1.

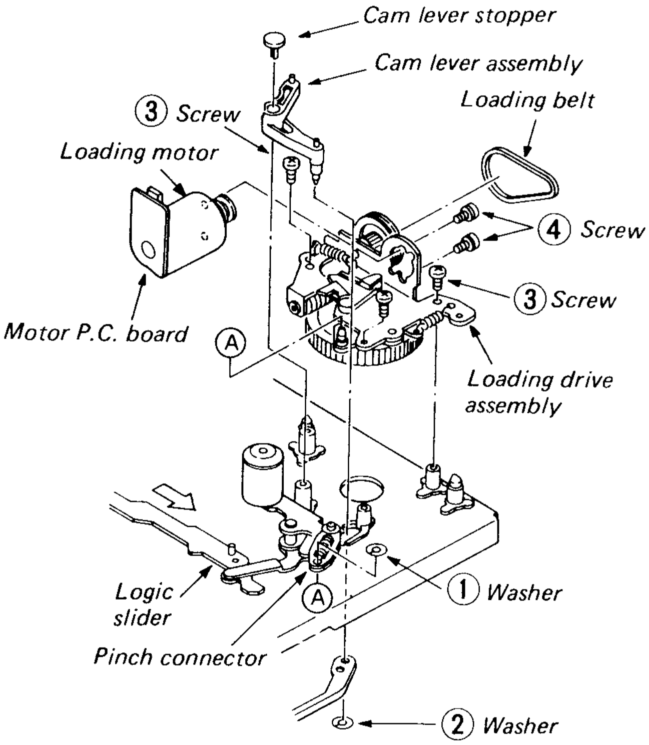

Cam lever stopper
Cam lever assembly
Loading belt
③ Screw
Loading motor
④ Screw
③ Screw
Motor P.C. board
Ⓐ
Loading drive assembly
Logic slider
Ⓐ
① Washer
Pinch connector
② Washer

Fig. 1-3-27 Loading motor replacement

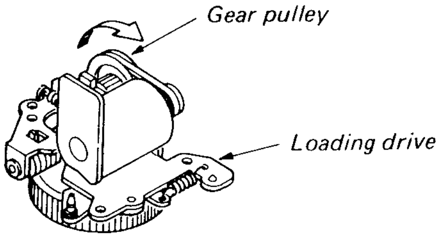

Gear pulley
Loading drive

Fig. 1-3-28 Loading drive·FF mode

1-3-6 Band brake assembly replacement

1) Remove the S-soft brake assembly.
2) Remove a tension spring from a tension lever.
3) Remove the screw ① and remove the tension lever and the band brake assembly from the main base.
4) Remove the band brake assembly from the tension lever and replace the band brake assembly.
5) Clean the shaft of the tension lever and then apply one or two drops of oil. When replacing with a new band brake assembly, perform the above steps in reverse order.
6) After completion of the replacement, check position of the tension pole and its adjustment (refer to 1-4-2) and check the backtension (refer to 1-4-3).

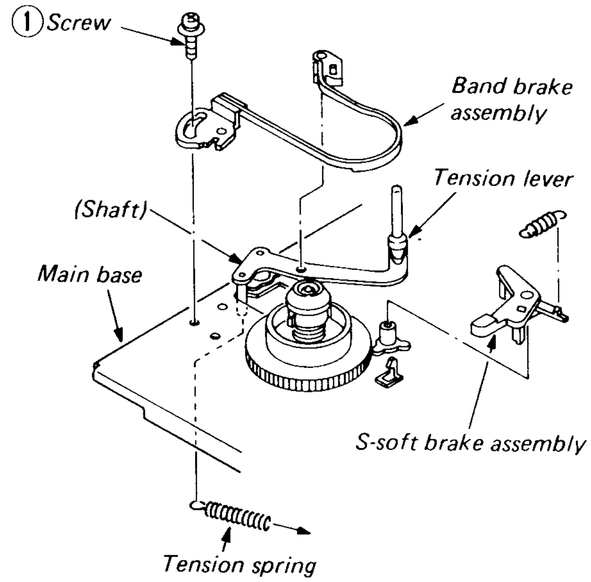

①Screw
Band brake assembly
Tension lever
(Shaft)
Main base
S-soft brake assembly
Tension spring

Fig. 1-3-29 Band brake assembly replacement

1-3-7 Cam switch replacement

1) Remove the screw ① and the cam switch bracket.
2) To remove the cam switch, move it upward with a screwdriver while opening the claw of the cam switch bracket.
3) Perform the phase matching adjustment (timing check), referring to the item 1-4-1.
4) Replace the cam switch and mount it on the cam switch bracket.
5) When mounting the cam switch on the phase gear shaft, mount the cam switch while pushing the external rim of the cam switch in the direction shown by the arrow.
(If the hole D of the cam switch and the cutout D of the phase gear shaft are not matched, (overlapped), turn the cam switch until the hole D matches.)

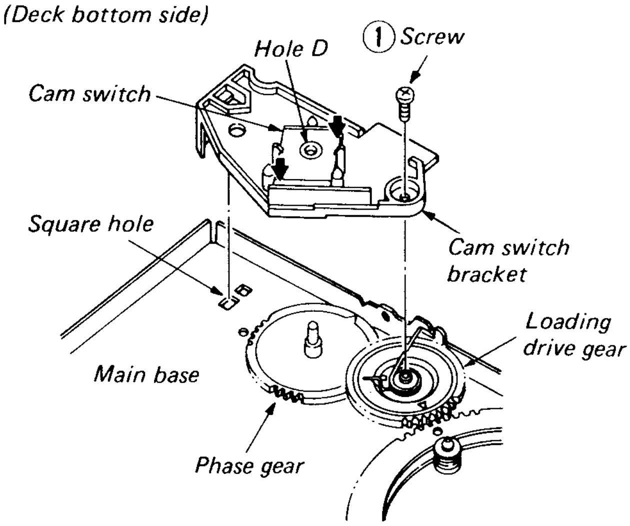

(Deck bottom side)
Hole D
①Screw
Cam switch
Square hole
Cam switch bracket
Loading drive gear
Main base
Phase gear

Fig. 1-3-30 Cam switch replacement

1-3-8 T.S. Sensors replacement

(1) Sensor assembly

1) Disconnect the connectors on P.C. boards.
   The T-sensor has 3P and 6P connectors, and the S-sensor has a 4P connector.
2) Remove the screws ①.
3) Remove the sensor assemblies ②.
4) When reinstalling a new sensor, perform the above steps in the reverse order.

Note: Since the Hall element is glued on the sensor holder, take care the hole element is not torn off during installation.

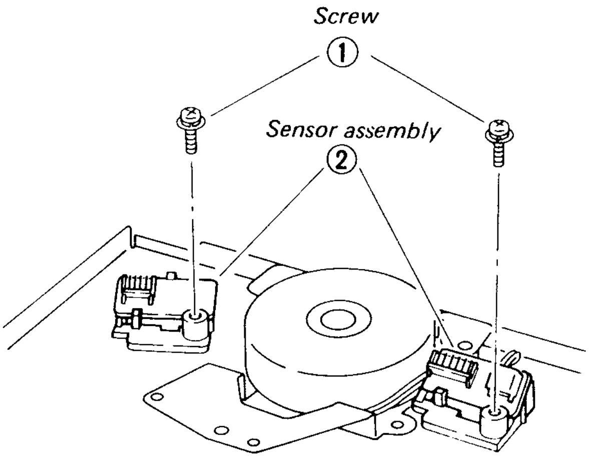


Fig. 1-3-31 Sensor assembly replacement

1-3-9 Main brake assembly replacement

(1) Brake assembly replacement

1) The brake assembly has the mold claws which allow one touch installation or removal.

Note: When replacing, take care not to touch the brake pad surface.

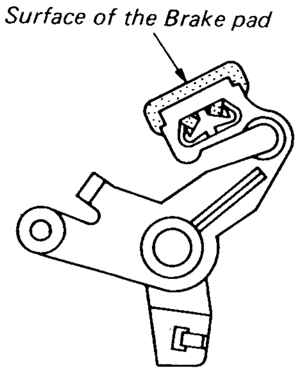


Fig. 1-3-32 Brake assembly replacement

1-3-10 Ground brush replacement

1) Remove a screw ① and a bush.
2) Clean the ground cap with alcohol.
3) Replace the brush.
   Mount a new brush so that it can contact the center of the ground cap.

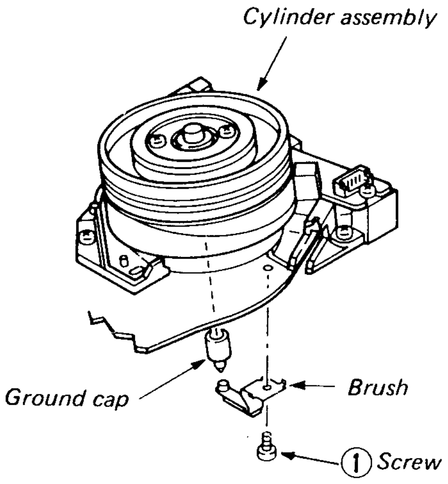


Fig. 1-3-33 Brush replacement

1-3-11 Reel table replacement

(1) Supply reel table assembly

1) Remove the S-soft brake spring ⑨ from the S-soft brake ① (Refer to Fig. 1-3-35).
2) Remove the S-soft brake ①.
3) Remove the tension spring ② from the tension lever ③.
4) Remove the screw ④, then remove the tension lever ③ and the band brake assembly ⑤.

Note: Take care not to damage the mold claw of the band brake.

5) Remove the washer ⑥, then remove the reel table ⑦ upward paying attention not to miss the spacers.

Note: Move the S brake assembly in the direction shown by the arrow before removing the reel table. Take care not to touch the pad surface of the S brake. (Fig. 1-3-34)

6) After cleaning the reel shaft ⑧ with a cleaning kit, lubricate it with one or two drops of oil (TOSHIBA lubrication kit).
7) When reinstalling the S-reel table assembly, temporarily move the S-brake assembly in the direction shown by the arrow, using a tweezers. (Fig. 1-3-35)
8) Confirm the spacers and the retainer assembly inserted into the reel shaft when the reel table mounts on the tape deck.
9) Mount the tension lever ③ and band brake assembly ⑤.

Note: The mold claw of the band brake can be engaged smoothly into the hole of tension lever by pushing it slightly. Take care not to deform the mold claw and the tension lever by forcing them.

10) Hook the tension spring ② onto the tension lever ③.

Note: In this case, take care not to give permanent deformation to the spring.

11) Mount the S-soft brake ①.
12) Mount the soft brake spring ⑨.

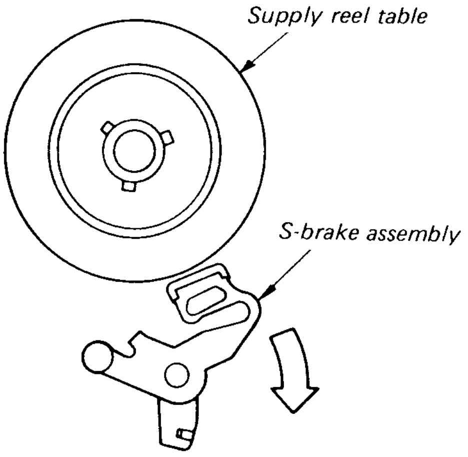

Supply reel table
S-brake assembly

Fig. 1-3-34 S-brake assembly

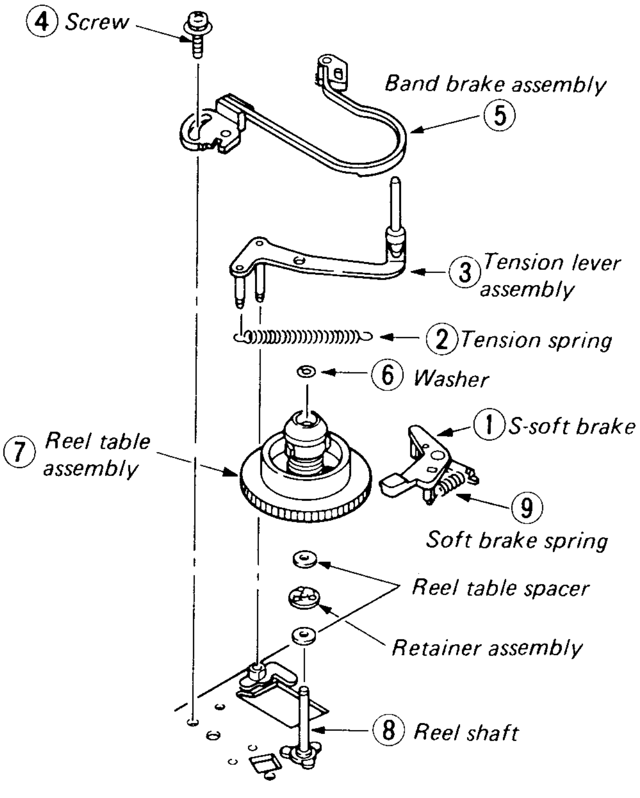

④ Screw
Band brake assembly
⑤
③ Tension lever assembly
② Tension spring
⑥ Washer
⑦ Reel table assembly
① S-soft brake
⑨
Soft brake spring
Reel table spacer
Retainer assembly
⑧ Reel shaft

Fig. 1-3-35 Supply reel table assembly replacement

(2) Take-up reel table assembly

1) Remove the reverse brake spring ① from the reverse brake assembly ②.
2) Remove the reverse brake assembly ② from the main base.
3) Remove the soft brake spring ③ from T-soft brake assembly ④.
4) Remove the T-soft brake assembly ④ from the main base.
5) Remove the washer ⑤ , then move the T brake assembly ⑩ in the direction shown by the arrow before removing the T-reel table assembly ⑥ . Take care not to touch the pad surface of T brake assembly ⑩.
6) As the bearing is stained with oil, the reel table spacer ⑦ , thrust washer ⑧ , washers ⑪ may stick to the T-reel table assembly and be removed with it. Take care not to miss the spacer(s).
7) Clean the reel shaft ⑨ using a cleaning kit, and apply one or two drops of oil (TOSHIBA lubrication kit) after the reel shaft has dried.
8) Replace the take-up reel table with a new one.
9) When mounting the take-up reel table ⑥, move the T-brake assembly ⑩ in the reverse direction shown by the arrow with tweezers.
10) Confirm the spacers and the retainer assembly inserted into the reel shaft when the reel table mounts on the tape deck.

1-3-12 Idler assembly replacement

Assume the front loading assembly is removed.

1) Removal of reel motor assembly (Fig. 1-3-37).
   Turn over the set, and remove three screws ① . Disconnect the 3P connector of the reel motor from the T-sensor assembly ④ . Move the idler assembly ③ in the direction shown by the arrow, then lift the reel motor assembly ② upward to remove it.

Note: Before remounting, always clean knurling surface of the motor pulley, using the TOSHIBA's cleaning kit. This is to prevent oil, dust, etc. from sticking on surface of the idler rubber.

2) Removal of idle stop bracket (Fig. 1-3-38)
   Remove two screws ①, then remove the idle stop bracket.
3) Remove the T-reel table assembly as previously stated. (Refer to 1-3-11 (2))
4) Remove the poly slider ①. (Fig. 1-3-39)
5) Remove the idle spring ② from the post.
6) Move the idler assembly ③ in the direction show by the arrow, up to the point shown in the Fig. 1-3-40.
7) Confirm that the idler assembly ③ is not caught with the main base. Lift the idler assembly upward.
8) When mounting, perform the above steps in reverse order.

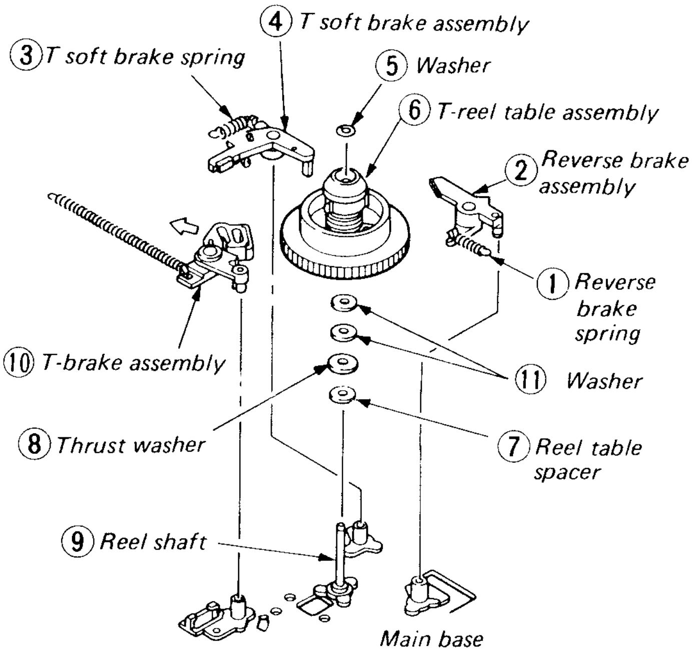

④ T soft brake assembly
③ T soft brake spring
⑤ Washer
⑥ T-reel table assembly
② Reverse brake assembly
① Reverse brake spring
⑩ T-brake assembly
⑪ Washer
⑧ Thrust washer
⑦ Reel table spacer
⑨ Reel shaft
Main base

Fig. 1-3-36 Take-up reel table assembly replacement

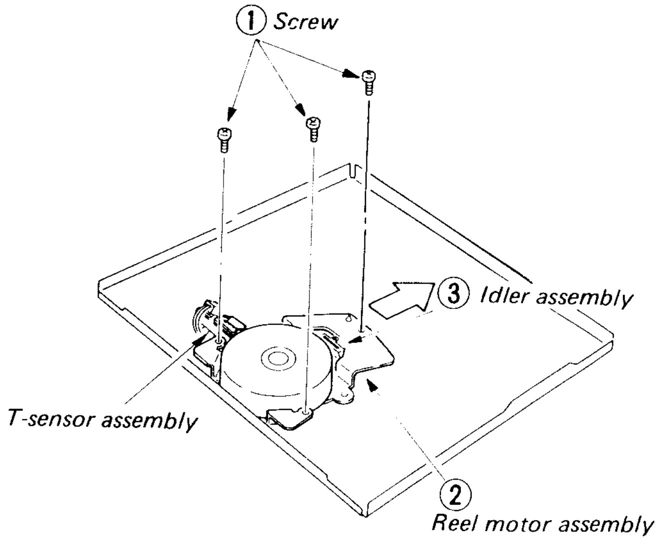

① Screw
③ Idler assembly
T-sensor assembly
② Reel motor assembly

Fig. 1-3-37 Removal of reel motor assembly

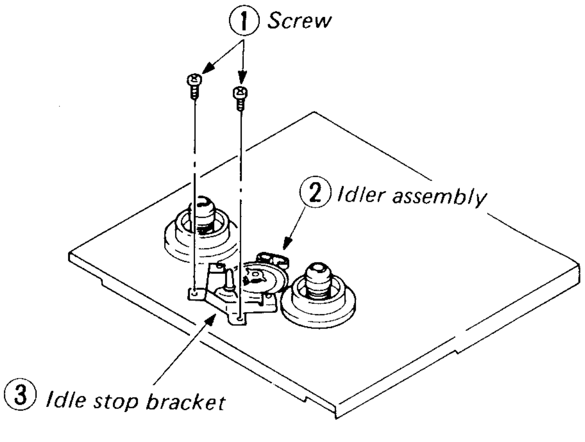

① Screw
② Idler assembly
③ Idle stop bracket

Fig. 1-3-38 Removal of idle stop bracket

9) When mounting the idler assembly, be sure to grease (refer to the Fig. 1-3-41).

Note: Be sure to confirm that grease does not stain the rubber when the idler swings. Excessive amount of grease applied may stain the rubber.

10) Be sure to clean the idler rubber with TOSHIBA cleaning kit.

Note: Make sure that the idler rubber is not stained with oil and dust. If stained, tape winding trouble may occur.

1-3-13 Capstan motor replacement

(1) Remove the 6P connector from the capstan motor. (Fig. 1-3-42)

(2) Remove the No. 9 guide lever assembly. (Refer to 1-3-3 (7))

(3) Remove three screws ①, then remove the capstan motor. (Fig. 1-3-43)

(4) Replace the capstan motor with a new one, and mount it using the above steps in reverse order.

Note: After the capstan motor was replaced, check the tape transport system, referring to 1-4-4.

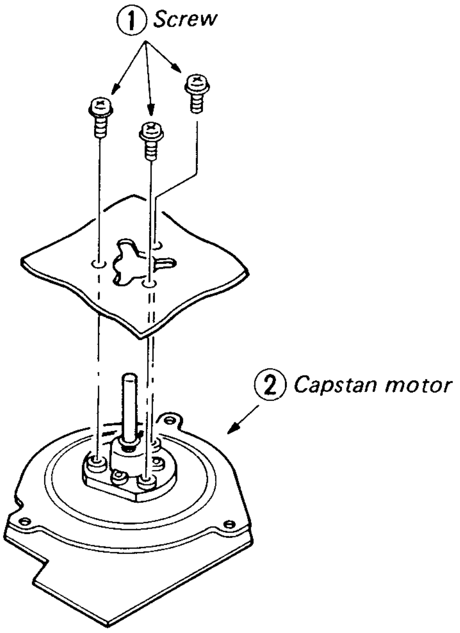

① Screw
② Capstan motor

Fig. 1-3-43 Capstan motor replacement (2)

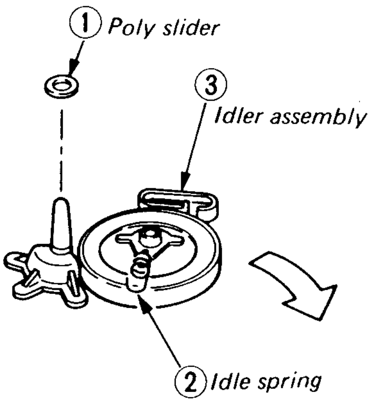

① Poly slider
③ Idler assembly
② Idle spring

Fig. 1-3-39 Idler assembly replacement (1)

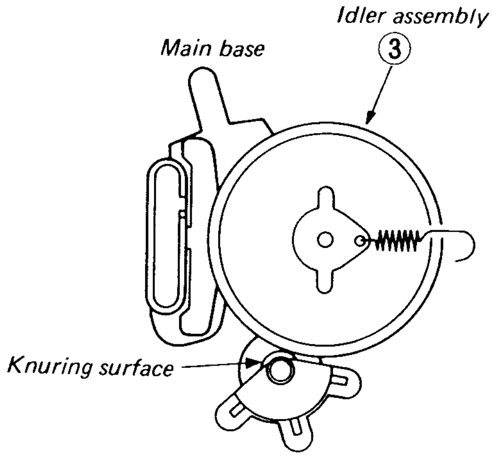

Idler assembly
Main base
③
Knuring surface

Fig. 1-3-40 Idler assembly replacement (2)

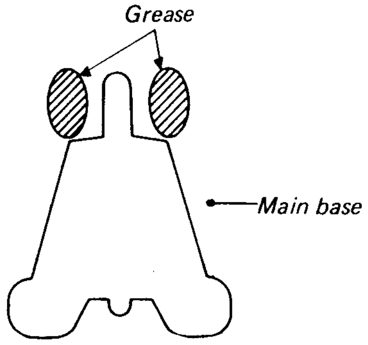

Grease
Main base

Fig. 1-3-41 Idler assembly replacement (3)

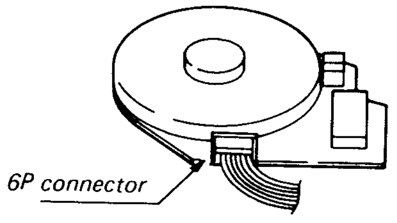

6P connector

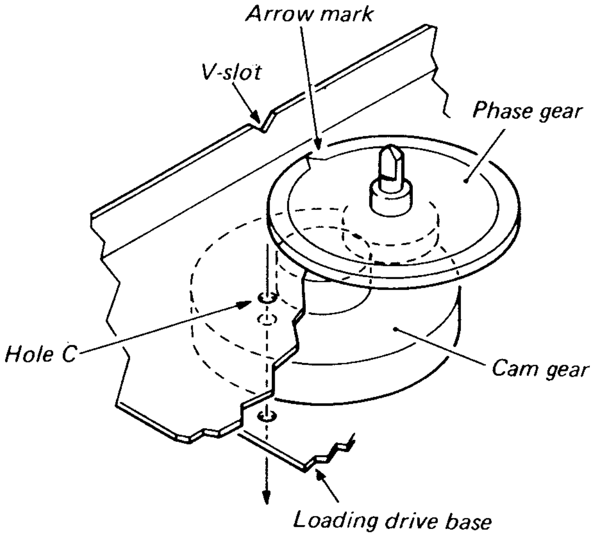
Fig. 1-3-42 Capstan motor replacement (1)

1-4. Check and Adjustment

1-4-1 Timing Check

(1) Cam gear and phase gear

1) Make sure through the C-hole on the main base that the holes on the cam gear and the loading drive base are coincided.
   If not, rotate the gear pulley assembly of the loading drive fully in the direction shown by the arrow to set FF mode. (Fig. 1-3-28)
2) Confirm the arrow mark of the phase gear is also coincided with the V-slot. If not coincided, adjust the timing by remounting the phase gear.

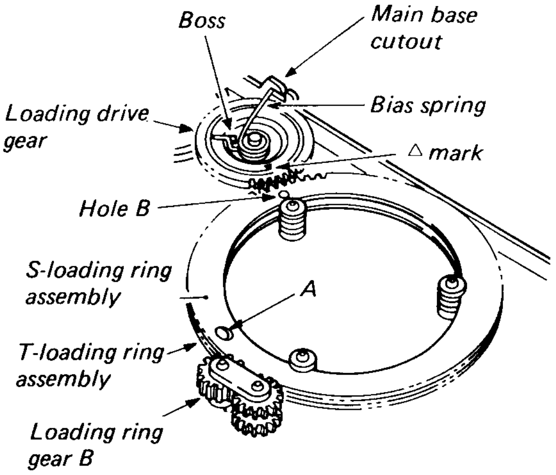


Arrow mark
V-slot
Phase gear
Hole C
Cam gear
Loading drive base

Fig. 1-4-1 Cam gear/phase gear

(2) Loading ring and loading drive gear

1) Make sure through the main base hole that holes of the S-loading ring and the T-loading ring are overlapped as shown by the arrow A. If they are not overlapped, adjust the location by removing the loading ring gear B.
2) Also make sure that the B-hole on the S-loading ring is coincided with the delta mark on the loading drive gear under the condition in the step 1) above. If they are not coincided, adjust the timing (location) by remounting the loading drive gear.
   (When remounting the loading drive gear, make sure one end of the bias spring is hooked on the main base cutout and the other end is hooked on the boss of the loading drive gear.)



Boss
Main base cutout
Loading drive gear
Bias spring
△ mark
Hole B
S-loading ring assembly
A
T-loading ring assembly
Loading ring gear B

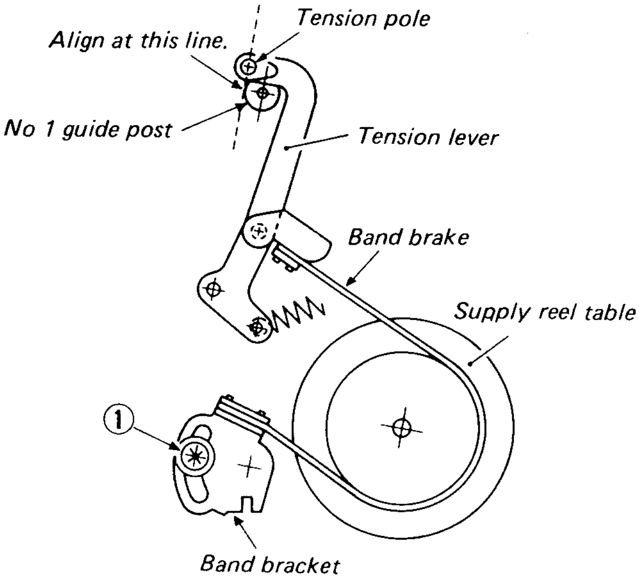
Fig. 1-4-2 Loading ring assembly/loading drive gear

1-4-2 Check and adjustment of Tension Pole Position

(1) Set the deck to play mode with the front loading assembly removed.

(2) Make sure a center of tension pole is in alignment with the left edge of No. 1 guide post (±1mm) as illustrated.

(3) If necessary, loosen the screw ① and adjust the mounting position of the band bracket.



Tension pole
Align at this line.
No 1 guide post
Tension lever
Band brake
Supply reel table
①
Band bracket

Fig. 1-4-3 Tension post position

1-4-3 Reel Torque

(1) Reel torque

1) REVIEW mode (supply side)

A large torque will cause damage on the tape at the REVIEW mode.

2) Record/Playback (take up side) mode

A small torque does not rewind the tape to the end. If too large, the tape may face the risk of being extended under extraordinary tension.

3) FF mode (take up side)

REW mode (supply side)

A small torque does not rewind the tape to the end or takes too much time for rewinding.

4) Inspection

Rewind the torque up to the end with a cassette, then check the torque shows the figure as shown below.

Review rewinding torque	190 ±10g-cm
Record/Playback	90 ∿ 70g-cm
FF/REW	over 600g-cm

(2) Reel torque adjustment

1) First record a TV broadcast program on entire torque cassette tape (KT-300NR) in the EP mode.

2) Load the torque cassette in the VCR and wind up the tape before proceeding measurement.

3) Set the VCR to the REVIEW mode and adjust R651 until the REVIEW take-up torque of 190 ± 5 g-cm is obtained while observing the left torque meter.

Next, make sure the REVIEW take-up torque is within 190 ± 10 g-cm.

4) After completion of the adjustment 3) above, set the VCR to the PLAY mode.

In this case, push the STILL/PAUSE button as soon as the play mode has been set. Wait several seconds and then set the VCR to the PLAY mode again.

Read the right torque meter and adjust R652 so that the PLAY take-up torque of 80 ± 10 g-cm is obtained.

If above value is not obtained, replace the reel motor assembly or idler assembly.

(Refer to item 1-3-12, and Figs. 1-3-38 through 1-3-42)

5) When the reel motor assembly or the idler assembly was replaced, check the items 2), 3), 4) in this order with the R651 maintained at the original position.

If the torque(s) is out of limit in the above checks, adjust R651 again.

6) Confirmation and adjustment of the back tension will be performed with the front loading mechanism removed from the set and terminals 4 and 9 of P604 (Servo, Logic P.C. Board) short-circuited, using a back tension cassette gauge.

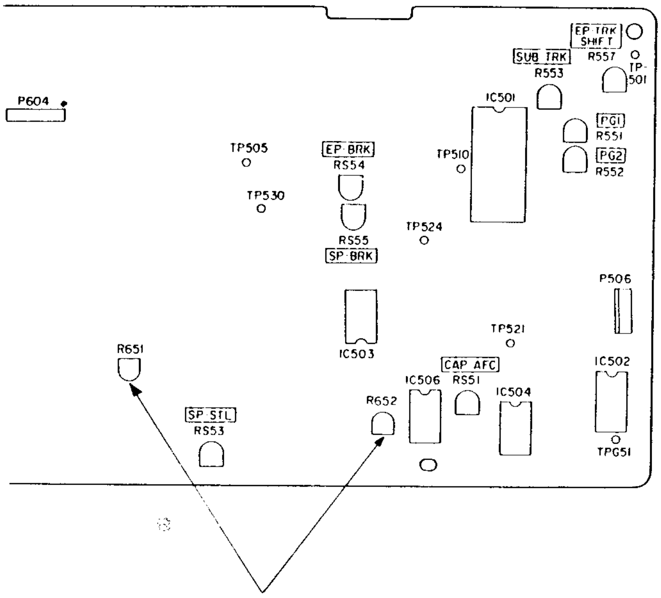
First, make sure that the tension pole is positioned correctly by referring to (item 1-4-2).

Load a back tension cassette and set the VCR to the PLAY (SP) mode.

Make sure the meter is indicating 16 – 26 gf.cm. If the value is out of limit, first make sure the tension level spring is normal, and then replace the band brake assembly as required. (Refer to item 1-3-6)

NOTE:

- If the reel torques are out of limits, clean the rubber surface of the idler assembly, the reel motor pulley, the reel table assembly, etc.
- Replace the idler assembly, if its rubber is hardened or worn out.
- Replace the brake pad of the main brake, if it is worn out.
- If the specified torque value is not obtained, replace the reel idler assembly.



Reel torque adjustment

Servo, Logic P.C. Board

PRECAUTIONS FOR USE OF TORQUE CASSETTE (KT-300NR)

1. Before loading a torque cassette in a VCR, always remove tape slack. The tape slack will be removed by rotating the reel to its take-up direction. (Particularily, the tape is tend to slack because of no reel brake provided.)
2. When the torque cassette is slotted in, confirm followings:
   a) Make sure the tape does not run on to No.8 cap or exceeds the cap. If the tape runs on or exceeds the cap, do not eject the tape but bring the tape to its correct position, taking care not to damage the tape.
   b) Make sure the tape is not slackened, if the tape slack, operate the VCR in FF or REW mode and then stop the tape. Then make sure the tape is not slacking again.
   c) After above confirmation, proceed to the reel torque adjustments and confirmation.
3. Cautions for removal of torque cassette
   a) When removing the torque cassette from the VCR, set the VCR to the STOP mode and wait for several seconds. Then, make sure the tape is not slacking. Push the EJECT button to remove the cassette.
   b) When removing the torque cassette from the VCR, also make sure the tape is not slacking inside the cassette lid before pulling the cassette from the VCR. If the tape is slacking inside the lid, carefully bring the tape in place and then pull the cassette.
4. Cautions for playback operation
   a) When making adjustments and confirmation in the PLAY (EP) mode, first push the PLAY key, and then push STILL/PAUSE key to set the STILL mode. Run the VCR for several seconds in the STILL mode. Release the STILL mode and set the PLAY mode.
   Then, perform the reel torque adjustments and confirmation works.
5. If above precautions 1, 2, 3 and 4 are not performed properly, the tape may be damaged and correct measurement can not be performed.
6. Do not use worn out or damaged tape, if used they may damage video heads on the cylinder. In such a case always replace the tape with new one.
   The replacement tape is of T-120 type, 6.01m ± 0.3m in length.

1-4-4 Tape Transport System

The tape transport system has been precisely adjusted in the factory, so no check and alignment are necessary except the followings:

- Noises observed on the screen
- Tape damage
- Parts, shown in the adjustment procedures for the tape transport system, item 1-3-3, were replaced.

< **Adjustment reference** >

Lower flange height of No. 8 guide is used as the basic reference for the transport adjustment, so do not move the No. 8 guide except replacing the No. 8 guide sleeve. When the adjustment is needed, perform the adjustment with extreme care, using the height adjustment jig. Refer to item 1-3-3 (2).

(1) Location of tape transport adjustment

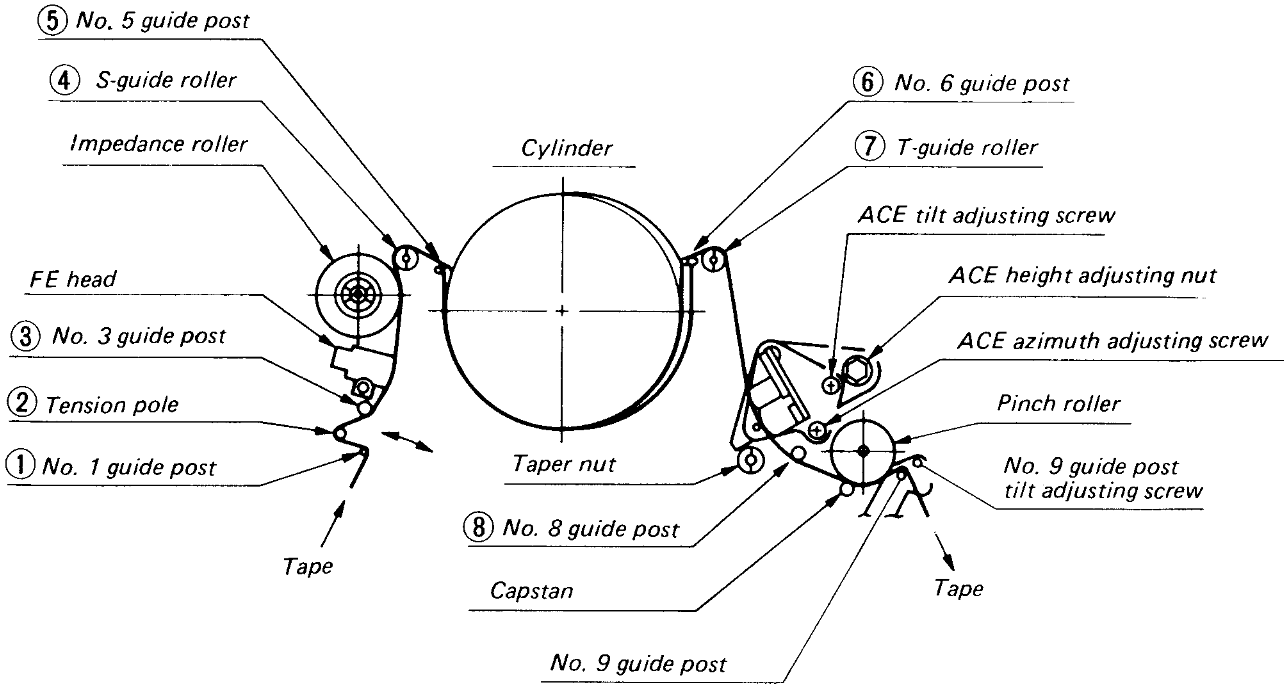

⑤ No. 5 guide post
④ S-guide roller
Impedance roller
FE head
③ No. 3 guide post
② Tension pole
① No. 1 guide post
Tape
Cylinder
Taper nut
⑧ No. 8 guide post
Capstan
No. 9 guide post
⑥ No. 6 guide post
⑦ T-guide roller
ACE tilt adjusting screw
ACE height adjusting nut
ACE azimuth adjusting screw
Pinch roller
No. 9 guide post tilt adjusting screw
Tape

Fig. 1-4-4 Locations of tape transport adjustment

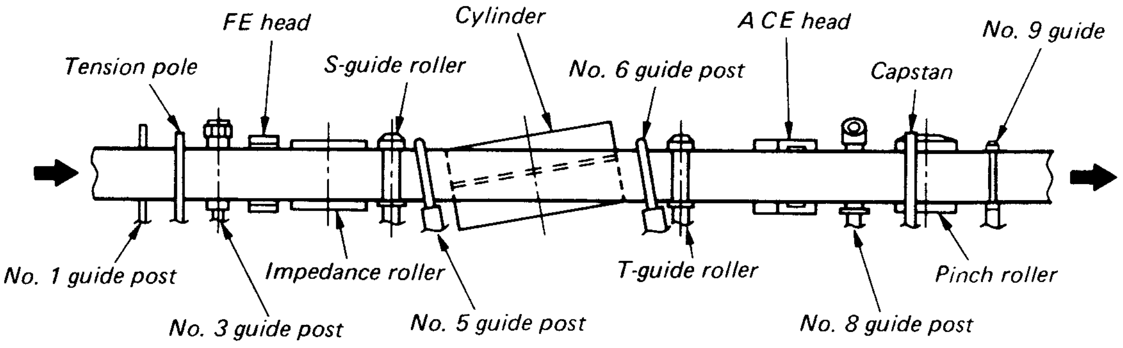
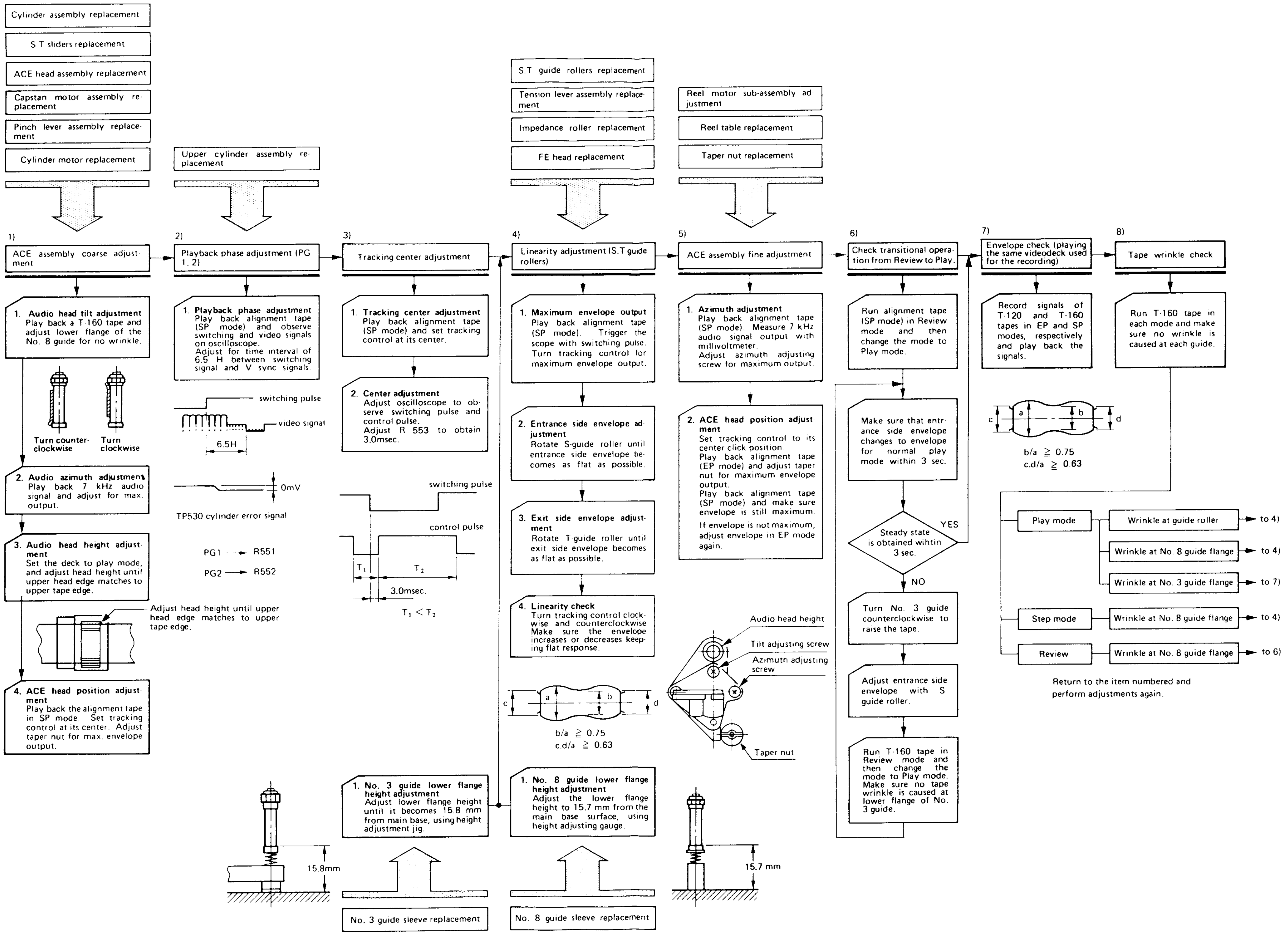

FE head
Cylinder
ACE head
No. 9 guide
Tension pole
S-guide roller
No. 6 guide post
Capstan
No. 1 guide post
Impedance roller
T-guide roller
Pinch roller
No. 3 guide post
No. 5 guide post
No. 8 guide post

Fig. 1-4-5 Tape travel diagram

(2) Tape transport system adjustment flow chart



Cylinder assembly replacement
S.T sliders replacement
ACE head assembly replacement
Capstan motor assembly replacement
Pinch lever assembly replacement
Cylinder motor replacement
Upper cylinder assembly replacement
S.T guide rollers replacement
Tension lever assembly replacement
Impedance roller replacement
FE head replacement
Reel motor sub-assembly adjustment
Reel table replacement
Taper nut replacement
1)
ACE assembly coarse adjustment
2)
Playback phase adjustment (PG 1, 2)
3)
Tracking center adjustment
4)
Linearity adjustment (S.T guide rollers)
5)
ACE assembly fine adjustment
6)
Check transitional operation from Review to Play.
7)
Envelope check (playing the same videodeck used for the recording)
8)
Tape wrinkle check
Turn counter-clockwise
Turn clockwise
switching pulse
video signal
6.5H
0mV
TP530 cylinder error signal
PG1 → R551
PG2 → R552
switching pulse
control pulse
T_1
T_2
3.0msec.
$T_1 < T_2$
15.8mm
No. 3 guide sleeve replacement
No. 8 guide sleeve replacement
15.7 mm
a
b
c
d
b/a ≧ 0.75
c.d/a ≧ 0.63
Audio head height
Tilt adjusting screw
Azimuth adjusting screw
Taper nut
YES
NO
Play mode
Step mode
Review
Wrinkle at guide roller → to 4)
Wrinkle at No. 8 guide flange → to 4)
Wrinkle at No. 3 guide flange → to 7)
Wrinkle at No. 8 guide flange → to 4)
Wrinkle at No. 8 guide flange → to 6)

1) ACE assembly coarse adjustment

1. **Audio head tilt adjustment**
Play back a T-160 tape and adjust lower flange of the No. 8 guide for no wrinkle.

2. **Audio azimuth adjustment**
Play back 7 kHz audio signal and adjust for max. output.

3. **Audio head height adjustment**
Set the deck to play mode, and adjust head height until upper head edge matches to upper tape edge.

Adjust head height until upper head edge matches to upper tape edge.

4. **ACE head position adjustment**
Play back the alignment tape in SP mode. Set tracking control at its center. Adjust taper nut for max. envelope output.

2) Playback phase adjustment (PG 1, 2)

1. **Playback phase adjustment**
Play back alignment tape (SP mode) and observe switching and video signals on oscilloscope.
Adjust for time interval of 6.5 H between switching signal and V sync signals.

3) Tracking center adjustment

1. **Tracking center adjustment**
Play back alignment tape (SP mode) and set tracking control at its center.

2. **Center adjustment**
Adjust oscilloscope to observe switching pulse and control pulse.
Adjust R 553 to obtain 3.0msec.

1. **No. 3 guide lower flange height adjustment**
Adjust lower flange height until it becomes 15.8 mm from main base, using height adjustment jig.

4) Linearity adjustment (S.T guide rollers)

1. **Maximum envelope output**
Play back alignment tape (SP mode). Trigger the scope with switching pulse. Turn tracking control for maximum envelope output.

2. **Entrance side envelope adjustment**
Rotate S-guide roller until entrance side envelope becomes as flat as possible.

3. **Exit side envelope adjustment**
Rotate T-guide roller until exit side envelope becomes as flat as possible.

4. **Linearity check**
Turn tracking control clockwise and counterclockwise Make sure the envelope increases or decreases keeping flat response.

1. **No. 8 guide lower flange height adjustment**
Adjust the lower flange height to 15.7 mm from the main base surface, using height adjusting gauge.

5) ACE assembly fine adjustment

1. **Azimuth adjustment**
Play back alignment tape (SP mode). Measure 7 kHz audio signal output with millivoltmeter.
Adjust azimuth adjusting screw for maximum output.

2. **ACE head position adjustment**
Set tracking control to its center click position.
Play back alignment tape (EP mode) and adjust taper nut for maximum envelope output.
Play back alignment tape (SP mode) and make sure envelope is still maximum.
If envelope is not maximum, adjust envelope in EP mode again.

6) Check transitional operation from Review to Play.

Run alignment tape (SP mode) in Review mode and then change the mode to Play mode.

Make sure that entrance side envelope changes to envelope for normal play mode within 3 sec.

Steady state is obtained wihtin 3 sec.

Turn No. 3 guide counterclockwise to raise the tape.

Adjust entrance side envelope with S-guide roller.

Run T-160 tape in Review mode and then change the mode to Play mode. Make sure no tape wrinkle is caused at lower flange of No. 3 guide.

7) Envelope check (playing the same videodeck used for the recording)

Record signals of T-120 and T-160 tapes in EP and SP modes, respectively and play back the signals.

8) Tape wrinkle check

Run T-160 tape in each mode and make sure no wrinkle is caused at each guide.

Return to the item numbered and perform adjustments again.

(3) Tape transport system adjustment

- **Pre-adjustment**

When the part(s) listed in table 1-4-1 was replaced, perform required adjustments by referring to procedures for the tape transport system.

When the part(s) listed in table 1-4-1 was replaced, the tape path may be changed and may damage alignment tape. To prevent this, first run a T-160 tape and make sure excessive tape wrinkle does not occur at each tape guide.

1) If tape wrinkle is observed at the No. 3 and the No. 8 guides, make sure of the preset height of these guides again.
2) If tape wrinkle is observed at the S, T guide rollers, turn the S, T guide rollers for no wrinkle.

- **Adjustment procedures**

1) ACE head assemby pre-adjustment

a. ACE tilt adjustment

a.1) Play back a T-160 tape and observe running condition of the tape at the lower flange of No. 8 guide.

a.2) Adjust the ACE tilt adjusting screw until tape wrinkle is caused at the lower flange of No. 8 guide as shown in Fig. 1-4-7(a).

a.3) Turn the ACE tilt adjusting screw counterclockwise until the tape travels along the lower flange as shown in Fig. 1-4-7(b).

b. Audio azimuth adjustment

b.1) Play back the alignment tape (SP mode; MH-1), 7 kHz portion of audio signals.

b.2) Connect a millivoltmeter to the audio line output terminal.

b.3) Turn the ACE azimuth adjusting screw to obtain maximum audio output.

Part replacement	Adjustment procedure
● Cylinder complete assembly ● S, T sliders ● ACE head assembly ● Capstan motor assembly ● Pinch lever assembly ● Cylinder motor	From item 1)
● Upper cylinder	From item 2)
● S, T guide rollers ● Tension lever assembly ● Impedance roller ● FE head ● No. 3 guide sleeve ● No. 8 guide sleeve	From item 4)
● Reel motor sub-assembly ● Reel table (S, T) ● Taper nut	From item 5)
● No. 9 guide lever	From item 6)

Table 1-4-1

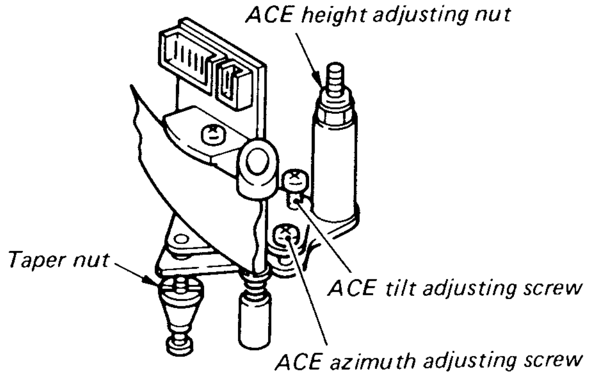


Fig. 1-4-6 A.C.E. head assembly

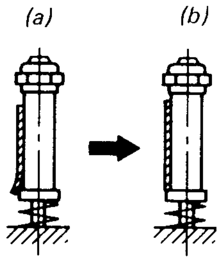


Fig. 1-4-7 No. 8 guide coarse check

c. Audio head height adjustment

c.1) Run the alignment tape (MH-1) in the play back mode.

c.2) Observe surface of the audio head using a dental mirror.

c.3) White ceramic is provided on both sides of the audio and control heads of the ACE head assembly.
Turn the ACE height adjusting nut so that upper tape edge matches to the lower edge of the ceramic on the upper audio head.
If the above method is difficult, play back the 1 kHz portion of the alignment tape (MH-(MH-1) and adjust for maximum audio output.

d. ACE head position pre-adjustment

d.1) Play back the alignment tape (MH-1).

d.2) Adjust the taper nut for maximum envelope output after the tracking control set at its center position.

Note: Before proceeding this adjustment, remove adhesive cement applied on the taper nut.

2) Playback phase adjustment (PG1, PG2 adjustment)

a. Play back the alignment tape (MH-1).

b. Observe a video signal on a oscilloscope display triggered with the switching pulse.

c. Adjust R551 for time interval of 6.5 ±0.5H between switching signal and V sync pulse. (Fig. 1-4-9(a))

d. Next, adjust R552 for minimum amplitude of the ripple voltage observed at TP530. (Fig. 1-4-9(b))

3) Tracking center adjustment

a. Play back the alignment tape (MH-1).

b. Adjust R553 so that phase difference of 3 ±0.5-msec is obtained between the falling edge of the switching pulse and the rising edge of the control pulse.

Note: In this case, adjust the tracking control at the click position.

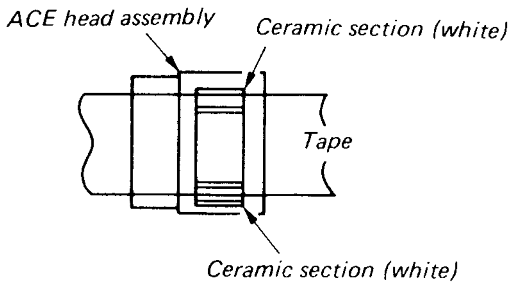


Fig. 1-4-8 Head height

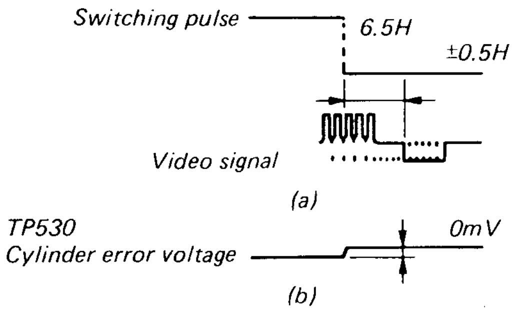


Fig. 1-4-9 Playback phase adjustment

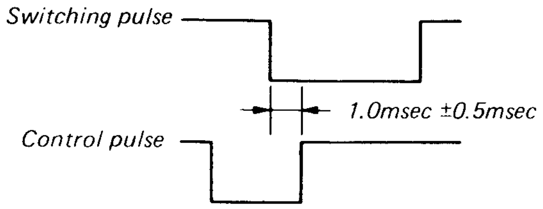


Fig. 1-4-10 Tracking center adjustment

4) Linearity adjustment (S, T guide rollers adjustment)

a. Play back a stair step signal on the alignment tape (MH-1).

b. Observe the signal envelope on a oscilloscope display triggered by the switching pulse.

c. Make sure the envelope waveform (in its maximum output) meets the specification shown in Fig. 1-4-11. If not, adjust as follows:

Note:

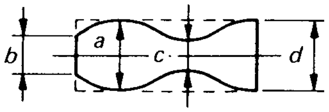
a = maximum output of the envelope
b = minimum output of the envelope at the cylinder entrance side
c = minimum output of the envelope at the cylinder center.
d = minimum output of the envelope at the cylinder exit side.

d. If the A section in Fig. 1-4-12 does not meet the specification, adjust the S-guide roller in up or down direction.

e. If the B section in Fig. 1-4-12 does not meet the specification, adjust T-guide roller in up or down direction.

f. After completion of the adjustment(s), turn the tracking control and make sure the envelope varies almost flat.

g. If the envelope varies as shown in Fig. 1-4-13, adjustment of the S, T guide rollers may be upset, and perform the adjustment again.



$c/a \geqq 0.75$: $b, d/a \geqq 0.63$

Fig. 1-4-11 Envelope waveform specification

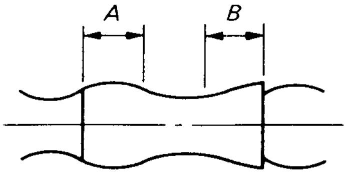


Fig. 1-4-12 Adjustment points

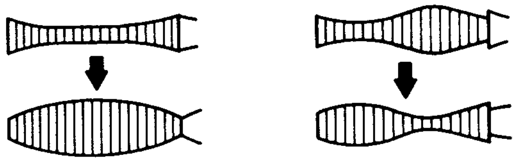


Fig. 1-4-13 Abnormal variation of the waveform

5) **ACE head assembly adjustment**

a. **Tape wrinkle check at the lower flange of No. 8 guide.**

a.1) If tape wrinkle is observed at the lower flange of No. 8 guide, adjust the ACE tilt adjusting screw counterclockwise as shown in Fig. 1-4-6 until the wrinkle disappears.

a.2) If a gap is observed between the lower flange of No. 8 guide and the lower edge of tape, adjust the ACE tilt adjusting screw clockwise until the tape travels along the lower flange.

Note: This adjustment should be made using a beginning part of T-160 tape.

b. **Azimuth adjustment**

b.1) Play back the 7 kHz audio signal on the alignment tape (MH-1).

b.2) Adjust the ACE azimuth adjusting screw for maximum audio output as shown in Fig. 1-4-6.

c. **ACE head position adjustment**

c.1) Play back the stair step signal on the alignment tape (MH-1).

c.2) Place the tracking control at its center click position.

c.3) Trigger an oscilloscope with the switching pulse and observe the envelope waveform of CH-2 output.

c.4) Turn the taper nut counterclockwise until the ACE base reaches the lower taper end of the taper nut as shown in Fig. 1-4-14.

c.5) Turn the taper nut slowly counterclockwise and fix the taper nut at the position where the envelope reaches a first peak level.

c.6) Play back the stair step signal on the alignment tape (MH-1L).

c.7) Make sure the envelope is maximum with the tracking control set to the center click position.

Note:
- If no envelope is observed with the tracking control set to the center position, perform the envelope adjustment to obtain maximum envelope in both SP and EP modes, again.
- If the maximum envelope output point is deviated (in terms of time) within ±6msec from the center of the tracking control, perform the fine adjustment for maximum envelope output, using the MH-1L.

  Play back the alignment tape (MH-1) and make sure the envelope waveform is maximum with the tracking control set to its center position.

  (Deviation of ±2msec or less from the maximum point will be accepted.)

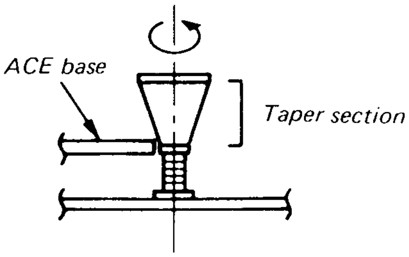


Fig. 1-4-14 Taper nut and ACE base

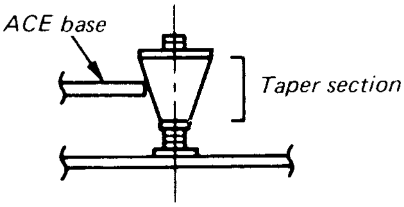


Fig. 1-4-15 Position of taper nut after adjsutment

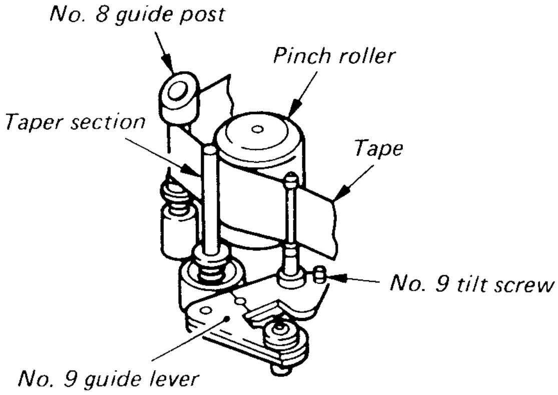


Fig. 1-4-16 No. 9 guide lever adjustment

c.8) Play back the stair step signal on the alignment tape (MH-1) and make sure the audio output is maximum.

Note: After completion of the ACE head position adjustment, the ACE base must be positioned at approximately the center of the taper nut as shown in Fig. 1-4-15.

6) No. 9 guide lever adjustment

a. Run a T-160 tape in the CUE mode.
When a proper length of the tape is wound on the take up reel, set the VCR to the Review mode.

b. Observe tape wrinkle at the lower or upper flange of the No. 8 guide.
If the tape travels along the lower flange without any wrinkle, no alignment is necessary.

b.1) If the tape travels along the upper flange or the tape wrinkle occurs, adjust the No. 9 tilt screw counterclockwise as shown in Fig. 1-4-16 until the tape travels along the lower flange without the wrinkle.

b.2) If the tape wrinkle occurs at the lower flange, adjust the No. 9 tilt screw clockwise until the wrinkle disappears.

7) Check for transitional operation from Review to Play

a. Play back the alignment tape (MH-1) in Review mode and observe the envelope with an oscilloscope.

b. Switch the Review mode to the Play mode
When switched to the Play mode, make sure the entrance side envelope becomes to an approximate steady state within 3 seconds as shown in Fig. 1-4-17.
If it does not rises within 3 seconds, adjust as follows:

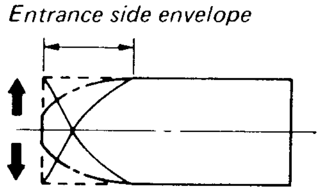


Fig. 1-4-17 Envelope rising when operation mode is switched from review to play mode

c. Turn the No. 3 guide nut counterclockwise to adjust the lower flange height as shown in Fig. 1-3-22.
Make sure the tape travels along the lower flange.

d. Play back a stair step signal. Since entrance side linearity varies as the height of No.3 guide varies, adjust the S-guide roller to correct the linearity.

e. Change operation mode from the Review to the Play mode again and make sure the entrance side envelope rises within 3 seconds. If not, perform the adjustment again from the item 3.)

f. Play back the T-160 tape in the Play mode and make sure no tape wrinkle occurs at the lower flange of the No. 3 guide.
If the tape is raised too high at the No. 3 guide, the tape will be damaged. So if tape wrinkle occurs, turn the No. 3 guide nut clockwise until the wrinkle disappears and then perform adjustment from the item d.

Note: If the rising characteristic is poor in Review mode, screen noises may occur in synchronous editing recording.
Perform the adjustment carefully.

8) Envelope check

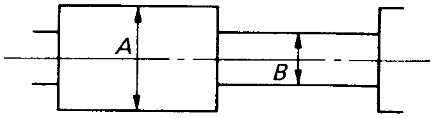
a. Make recordings on T-120 and T-160 tapes in both SP and EP modes, and make sure the playback output envelope meets the specification shown in Fig. 1-4-11.

b. In playing the same video deck used for the recording using the T-120, the envelope should meet the specification shown in Fig. 1-4-18.

c. If the performance does not meet both specifications a.) and b.), replace the upper cylinder assembly.

d. Set the deck to EP mode with T-120 tape wound at its beginning position and confirm operation of the synchronous editing.

e. If picture noises are observed at the starting position of the editing, adjust the preset height of the No. 3 guide again.



- $B/A \geqq 0.55$
- $B \geqq 120mV$

Fig. 1-4-18 Envelope output and output level difference

9) Tape wrinkle check

a. Play back the T-160 tape in the playback, Cue, Review and the frame feeding mode, and observe tape wrinkle at each guide.

b. If excessive tape wrinkle is observed at the mode shown below, perform the associated adjustments also shown below.

b.1) Play back mode
- Tape wrinkle at the S.T-guide roller section
  - Item 4: Linearity adjustment
- Tape wrinkle at No. 8 guide flange
  - Item 4: Linearity adjustment
- Tape wrinkle at No. 3 guide flange
  - Item 7: Rising characteristic check in mode change from Review to Play mode.

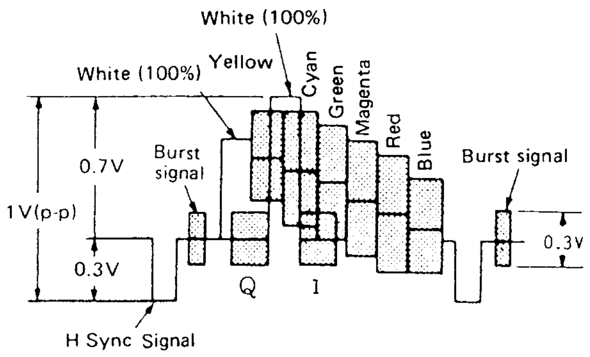
b.2) Cue/Review mode
- Tape wrinkle at No. 8 guide
  - Item 6: No. 9 guide lever adjustment

b.3) Frame feeding mode
- Tape wrinkle at No. 8 guide
  - Item 4: Linearity adjustment

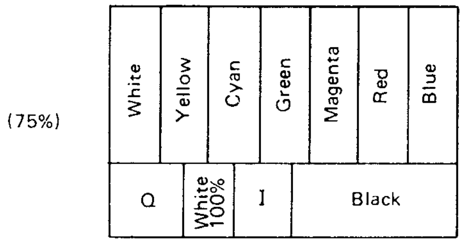
2. ELECTRICAL ADJUSTMENT

[Test equipments required]

(1) Color TV (Monitor)
(2) Oscilloscope, 2 CHs, 15 MHz or higher with delay system
(3) Frequency counter (7 digits or higher)
(4) Millivoltmeter
(5) Digital voltmeter
(6) Multimeter (20k ohm/V)
(7) AF signal generator
(8) AF signal attenuator
(9) Alignment tapes
Part code: MH-1; 70909110
MH-1L; 70909111
(10) Alignment screw driver (jig)
(11) Color pattern generator
(12) Video sweep generator


White (100%)
White (100%)
Yellow
Cyan
Green
Magenta
Red
Blue
0.7V
Burst signal
1V(p-p)
0.3V
Q
I
Burst signal
0.3V
H Sync Signal

Color bar signal wave


(75%)
White
Yellow
Cyan
Green
Magenta
Red
Blue
Q
White 100%
I
Black

Color bar pattern

Fig. 2-1-1

[Color bar signal]
Color bar signals of 75% recorded on the test tapes are shown in Fig. 2-1-1.

[Specified input and output levels, and impedance]
Video input: Negative sync, standard composite video signal 1Vp-p, 75 ohm
Video output: Same as the video input. 1Vp-p, 75 ohm
Audio input: –10 dBs, 47k ohm
Audio output: –7 dBs, 10k ohm

[Alignment sequence]
Proceed the alignment in the sequence as shown in Fig. 2-1-2.

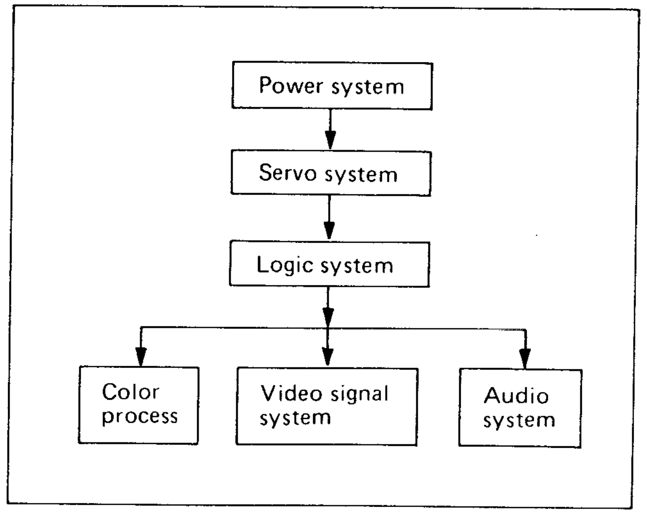
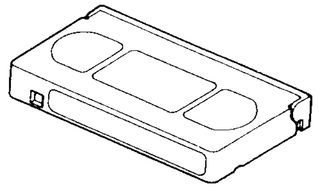

Power system
Servo system
Logic system
Color process
Video signal system
Audio system

Fig. 2-1-2

Alignment tape specifications

Alignment tape MH-1
MH-1L



[1] MH-1 (SP Mode)

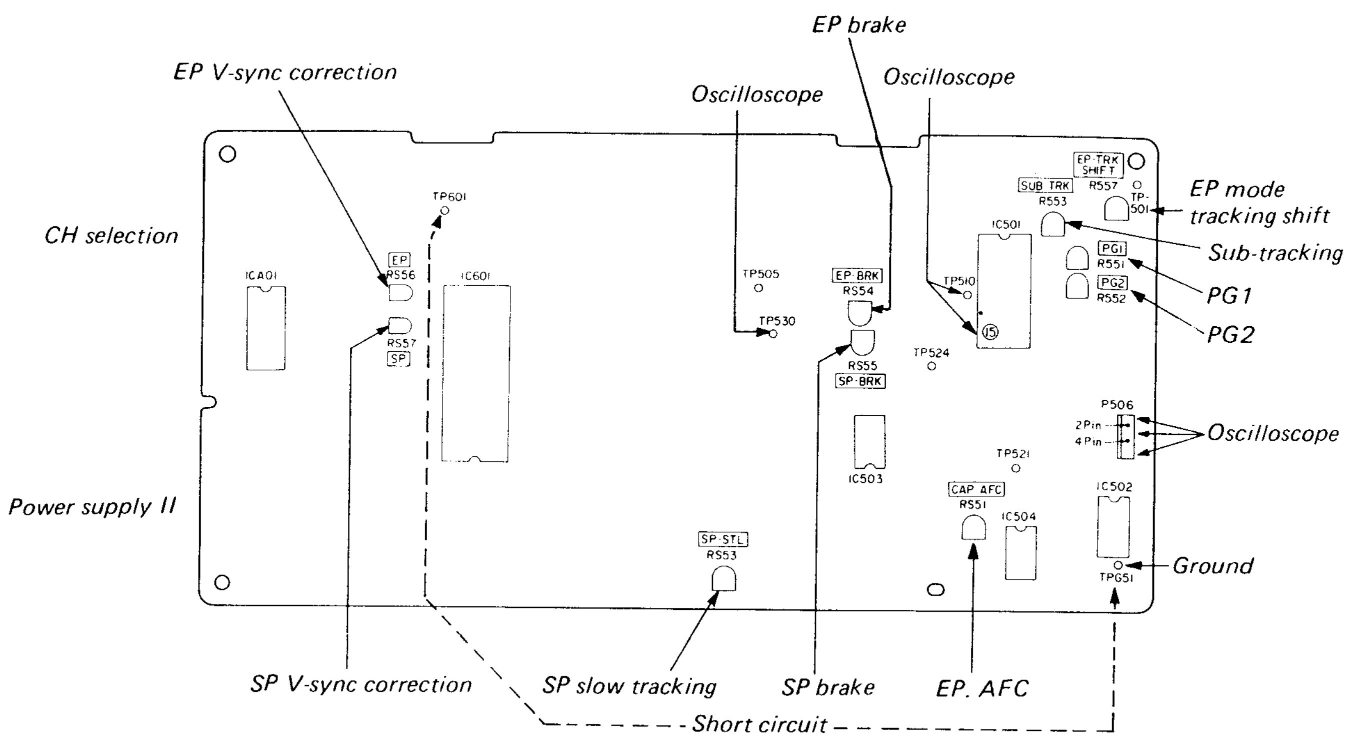
	Video signal	Audio signal	Items	Time
1	Stair step	7 kHz	• Check and adjustment of interchangeability • Check and adjustment of servo circuit • Audio head azimuth adjustment (Note): Set tracking volume to center click position.	10 min.
2	–	3 kHz	• Tape speed check • Wow & flutter check	5 min.
3	Color bar	1 kHz	• Check & adjustment of video signal playback circuit • Check & adjustment of audio playback circuit (Note): Manually adjust tracking control for max. FM output.	10 min.
4	RF sweep	–	• Video head resonance adjustment . . . Marker: 2.0, 4.0, 5.0 MHz	3 min.

[2] MH-1L (EP Mode)

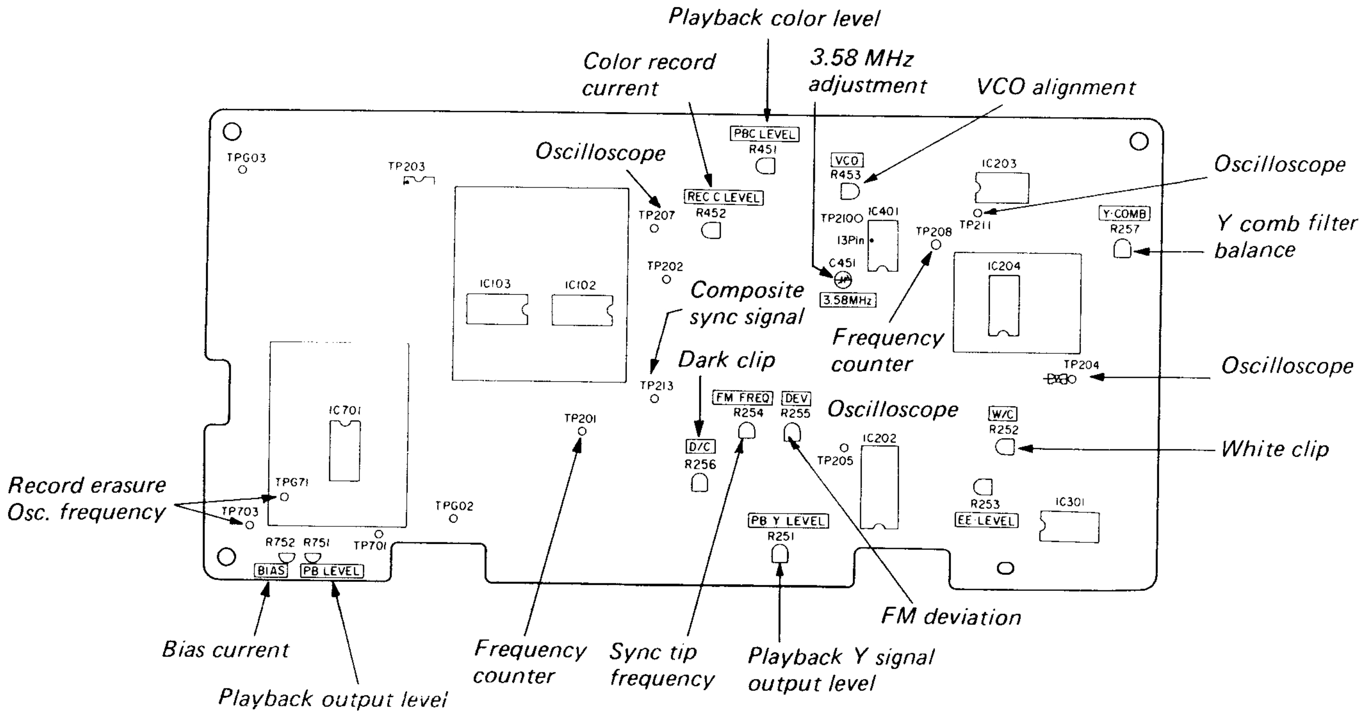
	Video signal	Audio signal	Items	Time
1	Stair step (CH-1 only)	–	• Check and adjustment of servo circuit (Note): Set tracking control to its center position.	5 min.
2	Color bar	–	• Check and adjustment of video signal playback circuit (Note): Manually adjust tracking control for max. FM output.	5 min.
3	RF sweep	–	• Video head resonance adjustment . . . Marker: 2.0, 4.0, 5.0 MHz	3 min.

< Adjustments points >

Servo, Logic P.C. Board


EP brake
EP V-sync correction
Oscilloscope
Oscilloscope
EP mode tracking shift
Sub-tracking
PG1
PG2
CH selection
Oscilloscope
Power supply II
Ground
SP V-sync correction
SP slow tracking
SP brake
EP. AFC
Short circuit
TP601
ICA01
IC601
EP R556
R557 SP
TP505
TP530
EP BRK R554
R555 SP BRK
TP510
TP524
IC501
SUB TRK R553
EP TRK SHIFT R557
TP501
PG1 R551
PG2 R552
P506
2Pin
4Pin
TP521
IC503
CAP AFC R551
IC504
IC502
TPG51
SP STL R553

Video, Audio P.C. Board

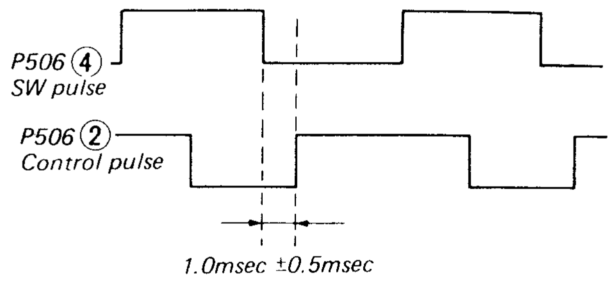

Playback color level
Color record current
3.58 MHz adjustment
VCO alignment
Oscilloscope
Oscilloscope
Y comb filter balance
Composite sync signal
Dark clip
Frequency counter
Oscilloscope
Oscilloscope
White clip
Record erasure Osc. frequency
FM deviation
Bias current
Playback output level
Frequency counter
Sync tip frequency
Playback Y signal output level
TPG03
TP203
PBC LEVEL R451
REC C LEVEL R452
TP207
TP202
VCO R453
TP2100
IC401
13Pin
C451
3.58MHz
TP208
TP211
IC203
IC204
Y-COMB R257
IC103
IC102
TP213
TP201
FM FREQ R254
DEV R255
D/C R256
TP205
IC202
W/C R252
TP204
R253 EE LEVEL
IC301
PB Y LEVEL R251
IC701
TPG71
TP703
TPG02
TP701
R752
R751
BIAS
PB LEVEL

2-1. Servo Circuit

2-1-1 Subtracking

(1) Place a tracking control knob in the click position.

(2) Play back a recorded tape in SP mode and adjust R553 so that phase difference between a falling edge of the SW pulse (P506 ④) and a rising edge of the control pulse (P506 ②) becomes 1.0msec ±0.5 msec.

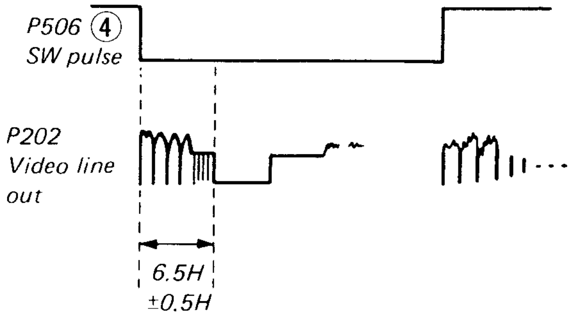

P506 ④
SW pulse
P506 ②
Control pulse
1.0msec ±0.5msec

2-1-2 Playback phase (PG1)

(1) Playback the alignment tape (MH-1). (Tracking control knob at its center click)

(2) Set the oscilloscope to the chop mode, and connect it to the SW pulse (P506 ④) and the video signal (P202, video line output).

(3) Adjust R551 to position the falling edge of SW pulse (P506 ④) at 6.5H ± 0.5H from the V-sync front edge of video signal (P202, video line output).

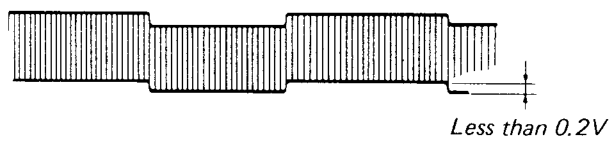

P506 ④
SW pulse
P202
Video line out
6.5H
±0.5H

2-1-3 Playback phase (PG2)

(1) Play back the test tape.

(2) Connect the oscilloscope to TP530.

(3) Adjust R552 for a minimum amplitude of the voltage ripple.


Less than 0.2V

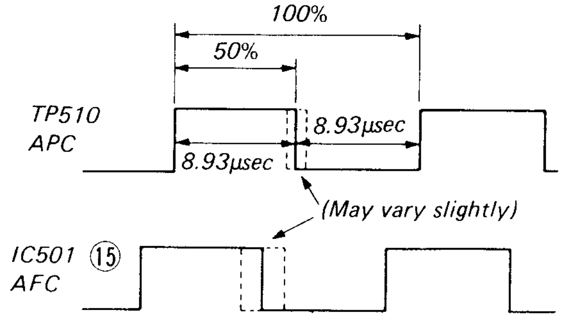
2-1-4 EP mode AFC

(1) Play back a tape recorded in EP mode.

(2) Connect the oscilloscope to TP510.

(3) Adjust RS51 so that the duty of 56kHz pulse becomes 50%.

In this case, always make sure the 56kHz pulse also appears at pin ⑮of IC501.

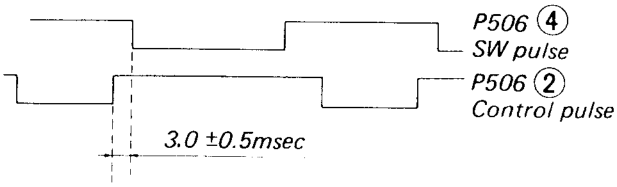

100%
50%
TP510
APC
8.93μsec
8.93μsec
(May vary slightly)
IC501 ⑮
AFC

2-1-5 EP mode tracking shift

(1) This alignment should be performed after completion of the EP mode AFC alignment.

(2) Place the tracking control knob at click position.

(3) Play back a tape recorded in EP mode and adjust R557 so that phase difference between the falling edge of the SW pulse (P506 ④) and the rising edge of the control pulse (P506 ②) becomes 3.0 msec ± 0.5 msec.

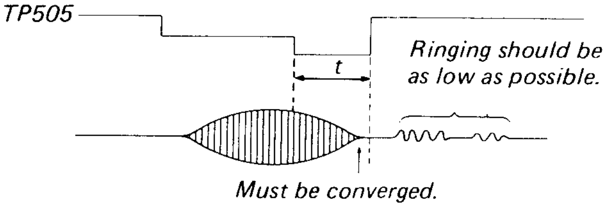


2-1-6 EP brake

(1) Short-circuit TP601 and TPG51 to release the audio muting operation.

(2) Play back a 3 kHz audio signal recorded in EP mode in the slow mode.

(3) Adjust RS54 so that the amplitude of the 3kHz signal is always converged to zero over a low area (t section) of the 3ST signal at TP505 and the ringing becomes as low as possible.



2-1-7 SP brake

(1) Short circuit TP601 and TPG51 to release the audio muting.

(2) Following adjustment should be performed after the EP brake adjustment.

(3) Play back a 3kHz signal recorded in SP mode in the slow mode.

(4) Adjust RS55 in the similar way as shown in 2-1-6 above so that the 3kHz signal converges to zero and the ringing becomes as low as possible.

2-1-8 EP slow tracking

(1) This alignment should be performed after completion of the alignments 2-1-6 and 2-1-7 above using a monitor.

(2) Play back an EP mode tape (recorded in the same machine under alignment) in the slow mode.

(3) Turn the slow tracking control knob on the front panel for no screen noise.

Note: After completion of this alignment, do not move the slow tracking control knob until the alignment 2-1-10 is completed.

2-1-9 EP V-sync correction

(1) Play back an EP mode tape (recorded in the same machine) in the still mode.

(2) Adjust the EP V-sync correction control RS56 for minimum vertical jitter at a center of the video monitor.

2-1-10 SP slow tracking

(1) This alignment should be performed after completion of 2-1-8 above. Also taking care the slow tracking control set in the procedure 2-1-8 is not moved.

(2) Play back a SP mode tape (recorded in the same machine) in the slow mode.

(3) Adjust RS53 for no screen noise.

2-1-11 SP V-sync correction

(1) Play back a SP mode self-recorded tape (recorded in the same machine) in the still mode.

(2) Adjust the SP V-sync correction control RS57 for minimum vertical jitter at the center of the monitor.

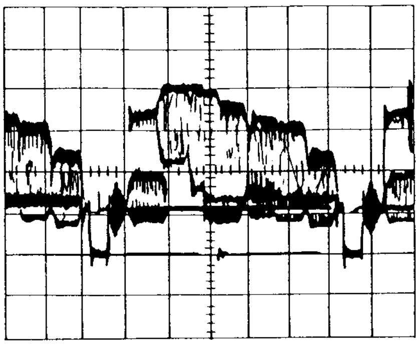
2-2. Video Circuit

2-2-1 Playback Y signal output level

(1) Playback the alignment tape (color bar signal).

(2) Connect the oscilloscope to TP204 and trigger the scope with a composite sync signal, TP213. Adjust the scope so that it can display a waveform of approx. 2H.

(3) Adjust R251 to obtain 2.0Vp-p ± 0.2Vp-p between the sync tip and 100% white level.



Horizontal axis: 10µs/div.
Vertical axis: 0.5V/div.

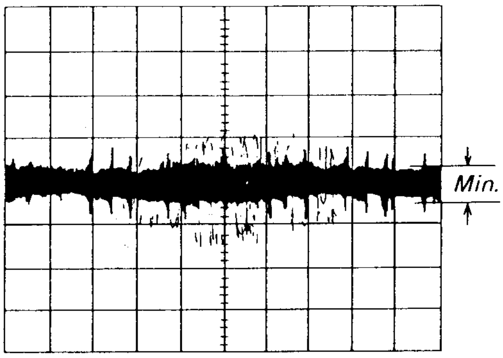
2-2-2 Y comb filter balance

(1) Playback the test tape (color bar signal) in the EP mode.

(2) Connect the oscilloscope to TP211 and trigger the scope with a composite sync signal TP213. Adjust the scope so that it can display a waveform of approx. 2H.

(3) Adjust R257 until an amplitude of difference signal becomes minimum.

(4) Proceed adjustment of "Playback Y signal output level" again.



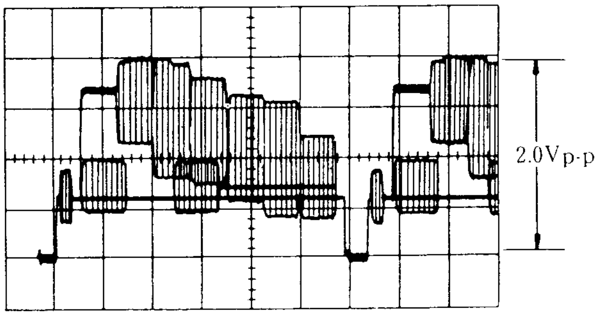
Horizontal axis: 10µs/div.
Vertical axis: 0.5V/div.

2-2-3 EE output level

(1) Feed the color bar signal to the line input terminal.

(2) Connect the oscilloscope to TP204 and trigger the scope with a composite sync signal TP213. Adjust the scope so that it can display a waveform of approx. 2H.

(3) Adjust R253 (video amplitude) to obtain 2.0Vp-p ± 0.2Vp-p between the sync tip and 100% white level.



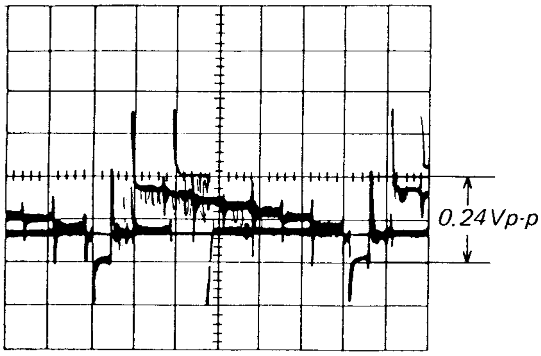
Horizontal Axis: 10µs/div.
Vertical Axis: 0.5V/div.

2-2-4 Sync tip frequency

(1) Change input selection switch to line side and set the VCR to the record mode without input.
(2) Connect a frequency counter to TP201.
(3) Adjust R254 to obtain frequency reading of 3.4 MHz ±0.1MHz.

2-2-5 FM deviation

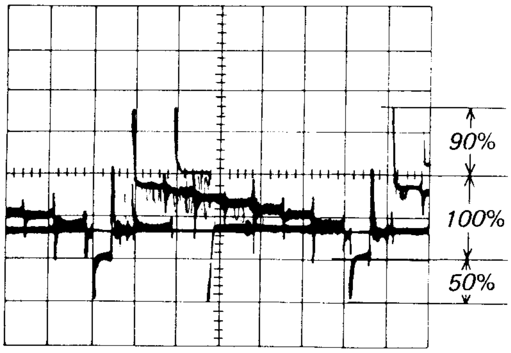
(1) Feed the color bar signal to the line input terminal.
(2) Connect the oscilloscope to TP205 and trigger the scope with a composite sync signal at TP213. Adjust the scope so that it can display a waveform of approx. 2H.
(3) Adjust R255 to obtain amplitude of approx. 0.24Vp-p between the sync chip and the white peak. After adjusting R251 (playback Y signal output level) with the method (1), adjust R255 (FM deviation control) so that the playback Y signal output level at TP204 shows 2.0Vp-p ±0.2Vp-p. (Refer to the waveform in 2-2-1).



Horizontal axis: 10μs/div.
Vertical axis: 0.1V/div.

2-2-6 White clip, dark clip

(1) Feed the color bar signal to the line input terminal. Do not push any operation buttons.
(2) Set the VCR to EP mode.
(3) Connect the oscilloscope to TP205 and trigger the scope with a composite sync signal at TP213. Adjust the scope so that it can display a waveform of approx. 2H.
(4) Adjust R252 so that an amplitude of overshoot appearing on the video signal side shows 90% $^{+0}_{-5}$ of a Y signal amplitude of 100%.
(5) Adjust R256 so that an undershoot appearing on the sync tip side shows 50% ± 5% of a Y signal amplitude of 100%.



Horizontal axis: 10μs/div.
Vertical axis: Adjust as illustrated, using a calibrator.

2-2-7 3.58MHz alignment

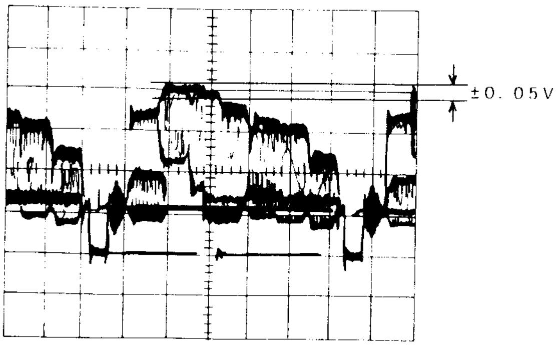
(1) Playback alignment tape (color bar signals).
(2) Connect a frequency counter to TP208 and set the measurement range to a position which allows reading accuracy of 1Hz.
(3) Adjust C451 trimmer until the frequency reading of 3.579545 MHz ±15Hz is obtained.

2-2-8 VCO alignment

(1) Feed the color bar signal to the line input terminal.
(2) Measure the voltage of 5V line (Ev).
(3) Apply 1/2E ± 0.05V DC to TP212 (pin ⑬ of IC401).
(4) Connect the frequency counter to TP210 and set the measurement range to a position that allows reading accuracy of 1kHz.
(5) Adjust R453 until a frequency reading of 5.15 ± 0.05 MHz is obtained.

2-2-9 Playback color level

(1) Playback the alignment tape (color bar signal).
(2) Connect the oscilloscope to TP204 and trigger it with a composite sync signal (TP213). Adjust the oscilloscope so that it can display waveform of approx. 2H.
(3) Adjust R451 (playback color level) so that a difference between a peak of yellow color signal and the 100% white level is within ± 0.05V.

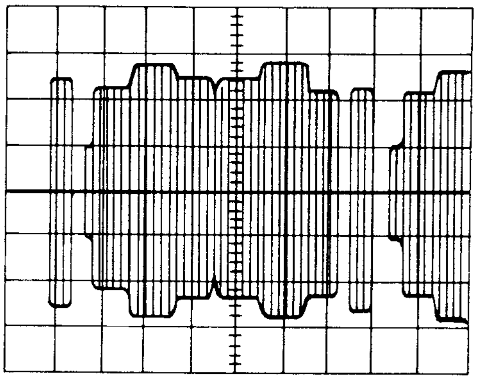


Horizontal axis: 10µs/div.
Vertical axis: 0.5V/div.

Note:	Before proceeding to this alignment, make sure that the playback Y signal level adjustment has been completed.

2-2-10 Color record current

(1) Connect the color bar signal to the line input terminal, and set the VCR to the record mode (SP mode).
(2) Connect oscilloscope to TP207 and trigger the scope with a composite sync signal (TP213). Adjust the oscilloscope so that it can display waveform of approx. 2H.
(3) Adjust R452 to obtain a red signal amplitude of 120 ± 10mVp-p.

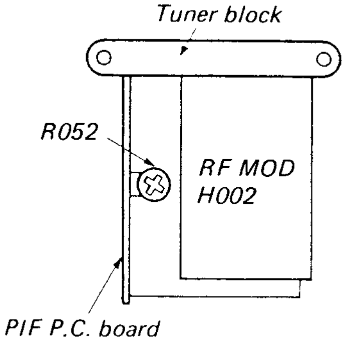


Horizontal axis: 10µs/div.
Vertical axis: 20mV/div.

2-3. PIF, Channel Selection Circuit

AGC delay

Apply 61 dB input signal to the ANT terminal of the VCR.
Adjust R052 so that 6.0 ±0.5V is obtained at the tuner's RF AGC terminal (TP-015).



2-4. Audio Circuit

Notes:

- Adjustments for the playback frequency response and playback output level may not be performed if the audio control head is improperly positioned on the audio track. In such a case, perform the azimuth adjustment and height adjustment perfectly, and then proceed the adjustments 2-4-1 – 2-4-4.
- When using alignment tapes other than those specified below always make sure that interchangeability is assured for the tapes before proceeding the adjustments.

2-4-1 Playback output level

(1) Connect 47k ohm to the audio line output terminal and playback the alignment tape (MH-1).
(2) Adjust R751 until output level obtains –7 dBs ±0.5 dBs.

2-4-2 Record/Erase oscillator frequency

(1) Connect the frequency counter across TP703 and TPG71 (ground).
(2) Set the VCR to record mode and check that the frequency counter shows 67.5 kHz ±6.7 kHz.

2-4-3 Bias current

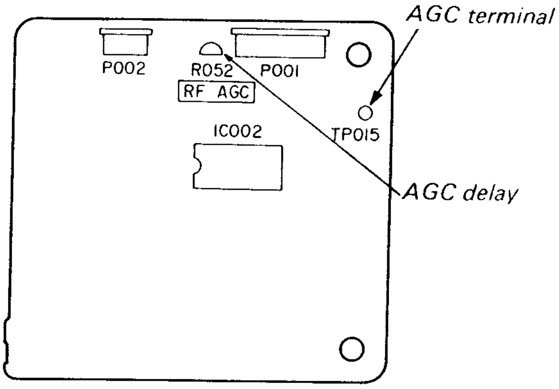
(1) Short circuit the audio line input terminal, creating no input signal condition. Connect a millivoltmeter to PM72①-②(GND).
(2) Set the VCR to the record mode and adjust R752 to obtain 2.4mV rms.

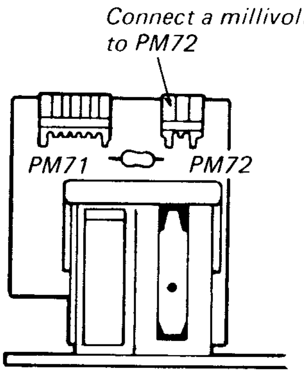
2-4-4 Record/playback frequency characteristics

(1) Set the SP/EP mode select switch to the SP position.
(2) Connect 47k ohm to the audio line output terminal.
(3) Apply 400 Hz and 10 kHz signals of –25 dBs to audio line input terminal, and record the signal.
(4) Playback the signals just recorded and check that the output of 10 kHz is + 1 dB $^{+3}_{-4}$ dB referred to the output of 400 Hz.
(5) If the 10 kHz output is higher than that of 400 Hz by more than +4 dB, adjust the bias current to a value higher than 2.4 mVrms; and if the 10 kHz output is lower than that by less than –3 dB, adjust the bias current to a value lower than 2.4mV rms.
(6) Set the SP/EP select switch to the EP position.
(7) Proceed steps (2) and (3) above..
(8) Playback and check that the 5 kHz output is 0 dB $^{+4}_{-5}$ dB referred to the 400 Hz output.

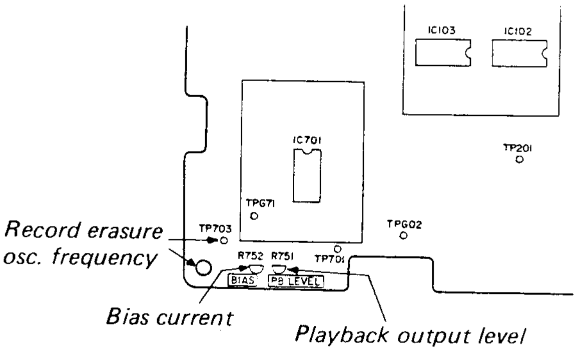
2-4-5 Record/playback output level

(1) Set SP/EP switch to the SP position.
(2) Connect a 47k ohm resistor to the audio line output.
(3) Feed 400 kHz, –10 dBs signal to the audio line input.
(4) Confirm to see the playback output level is –7 dBs ±3 dB.


AGC terminal
P002
R052
P001
RF AGC
IC002
TP015
AGC delay


Connect a millivoltmeter to PM72
PM71
PM72

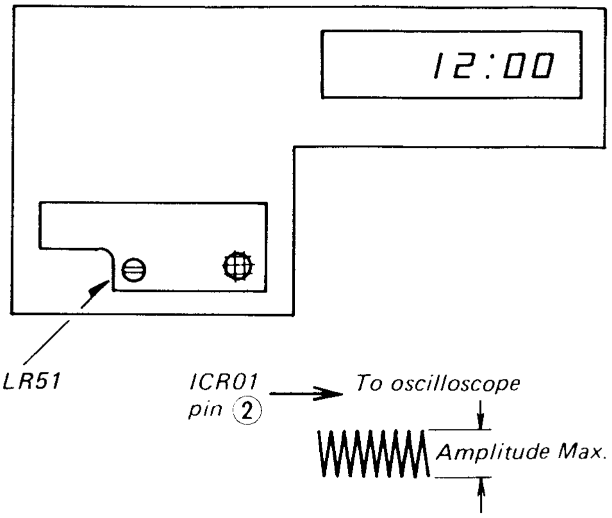
Audio control head

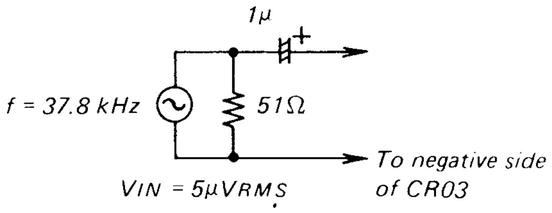

IC103
IC102
IC701
TP201
TPG71
TP703
TPG02
R752
R751
TP701
BIAS
PB LEVEL
Record erasure osc. frequency
Bias current
Playback output level

2-5 Wireless Remocon Circuit (light sensor IC sensitivity alignment)

1) Connect the oscilloscope across pin ② of ICR01 and ground.
2) Feed a signal of 37.8 kHz with amplitude of 5 μVrms across pin ⑧ of ICR01 and (–) side of CR03 through the network as shown.
3) Adjust LR51 for the maximum amplitude on the scope display.

Timer PC board


12:00
LR51
ICR01 pin ②
To oscilloscope
Amplitude Max.


1μ
+
f = 37.8 kHz
51Ω
To negative side of CR03
VIN = 5μVRMS